Temperature Versus Resistance - Engine Coolant Temperature Sensor

Temperature C°/F°	Resistance Minimum Ohms	Resistance Maximum Ohms
Engine Coolant Temperature (ECT)		
-40/-40	40,490	50,136
-20/-4	14,096	16,827
-10/14	8,642	10,152
0/32	5,466	6,326
20/68	2,351	2,649
25/77	1,941	2,173
40/104	1,118	1,231
60/140	573	618
80/176	313	332
100/212	182	191
120/248	109	116
140/284	068	074

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Temperature Versus Resistance - Intake Air Temperature Sensor

Temperature C°/F°	Resistance Minimum Ohms	Resistance Maximum Ohms
Intake Air Temperature (IAT) Sensor		
-40/-40	35,140	43,760
-20/-4	12,660	15,120
-10/14	7,943	9,307
0/32	5,119	5,892
20/68	2,290	2,551
25/77	1,900	2,100
40/104	1,096	1,238
60/140	565	654
80/176	312	370
100/212	184	222
120/248	114	141
140/284	74	93

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Altitude Versus Barometric Pressure

Altitude Measured in Meters (m)	Altitude Measured in Feet (ft)	Barometric Pressure Measured in Kilopascals (kPa)
Determine your altitude by contacting a local weather station or by using another reference source.		
4 267	14,000	56-64
3 962	13,000	58-66
3 658	12,000	61-69
3 353	11,000	64-72
3 048	10,000	66-74
2 743	9,000	69-77
2 438	8,000	71-79
2 134	7,000	74-82
1 829	6,000	77-85
1 524	5,000	80-88
1 219	4,000	83-91
914	3,000	87-95
610	2,000	90-98
305	1,000	94-102
0	0 Sea Level	96-104
-305	-1,000	101-105

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Ignition System Specifications

Application	Specification	
	Metric	English
Firing Order	1-2-3-4-5-6	
Spark Plug Gap (non-adjustable)	1.10 mm	0.044 in
Spark Plug Torque	20 N·m	15 lb ft
Spark Plug Type	AC 41-988	

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Fastener Tightening Specifications

Application	Specification	
	Metric	English
Accelerator Pedal Position (APP) Sensor Bolt	9 N·m	80 lb in
Air Cleaner Bolt	9 N·m	80 lb in
Camshaft Position (CMP) Actuator Solenoid Valve to Engine Front Cover Retaining Bolt	10 N·m	89 lb in
Camshaft Position (CMP) Sensor to Engine Front Cover Retaining Bolt	10 N·m	89 lb in
Crankshaft Position (CKP) Sensor Bolt	10 N·m	89 lb in
Engine Control Module (ECM) Bracket to chassis Bolt	10 N·m	89 lb in
Engine Coolant Temperature (ECT) Sensor	22 N·m	16 lb ft
Evaporative Emission (EVAP) Canister Bolt	6 N·m	53 lb in
Fuel Filler Tube Brace Bolt	9 N·m	80 lb in
Fuel Filler Tube Hose Clamp	4 N·m	31 lb in
Fuel Tank Strap Bolt	50 N·m	37 lb ft
Heated Oxygen Sensor (HO2S)	42 N·m	31 lb ft
Ignition Coil Bolt	10 N·m	89 lb in
Intake Manifold Runner Control Solenoid Bolt	10 N·m	89 lb in
Knock Sensor Bolt	23 N·m	17 lb ft
MAF Sensor Screw	4 N·m	35 lb in
Rear Frame Bolt		
- First pass	65 N·m	48 lb ft
- Final pass	120 degrees	
Spark Plugs		
- Fit New Spark Plug	20 N·m	15 lb ft
- Refit Existing Spark Plug	18 N·m	13 lb ft
Throttle Body Bolts to Upper Intake Manifold Retaining Bolts	10 N·m	89 lb in

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Engine Control Module Replacement

Pre-Removal Procedure

Note: It is necessary to record the remaining engine oil life. If the replacement module is not programmed with the remaining engine oil life, the engine oil life will default to 100%. If the replacement module is not programmed with the remaining engine oil life, the engine oil will need to be changed at 5000 km (3,000 mi) from the last engine oil change.

Using a scan tool, retrieve the percentage of remaining engine oil and the remaining automatic transmission fluid life. Record the remaining engine oil and the remaining automatic transmission fluid life.

If the engine control module (ECM) is replaced, the following procedures must be performed:

Note: When replacing the ECM, the ECM must be reset prior to removal. Failure to perform this procedure will result in the inability to:

- Test the ECM for warranty purposes.
- Install the ECM into other vehicles.

1. ECM reset procedure.
2. ECM reprogramming--Refer to Service Programming System (SPS) Caution.
3. Theft Deterrent programming--Refer to Theft Deterrent Control Module Programming and Setup Theft Deterrent Control Module Programming and Setup.

Removal Procedure

Warning: Refer to Safety Glasses Warning in the Preface section.

Caution: Always turn the ignition off when installing or removing the ECM connectors in order to prevent damage to the components.

1. Turn the ignition OFF.
2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.
3. Remove the radiator air baffle and deflector. Refer to Radiator Air Upper Baffle and Deflector Replacement.

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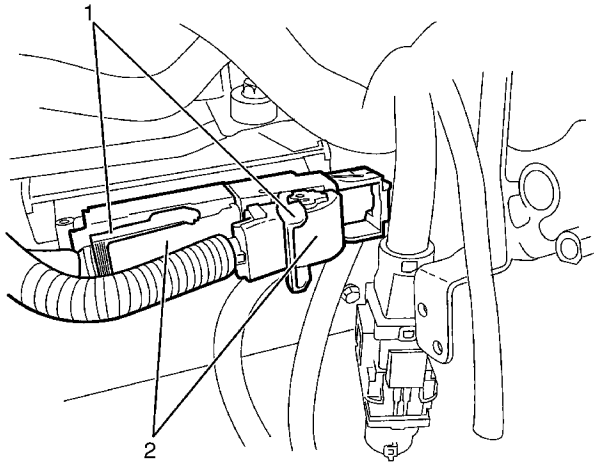
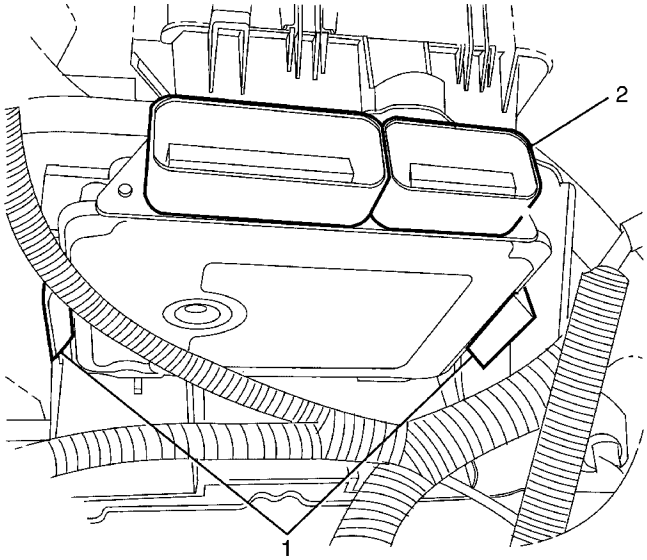


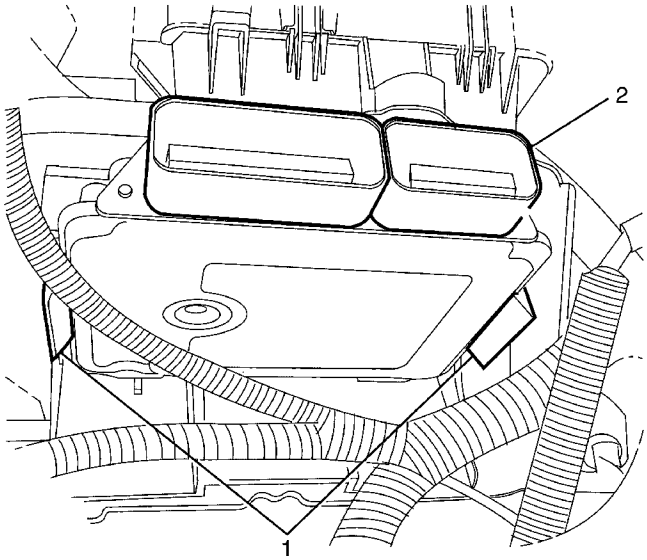
Note: Disconnect the rear electrical connector from the ECM first.

4. Unlock the ECM electrical connector lock levers (1) and disconnect the ECM electrical connectors (2).

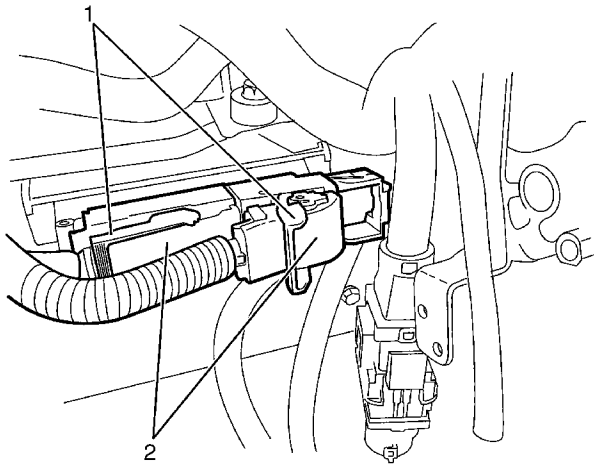


5. Remove the ECM (2) from the ECM housing by pushing both ECM retaining clips (1) outwards.

Installation Procedure



1. Install the ECM (2) to the ECM housing. Ensure the ECM retaining clips (1) are located correctly.



2. Connect the ECM electrical connectors (2) and lock the connector lock levers (1) into place.
3. Connect the battery negative cable to the battery. Refer to Battery Negative Cable Disconnection and Connection.
4. Install the radiator air baffle and deflector. Refer to Radiator Air Upper Baffle and Deflector Replacement.

Note: If the ECM is replaced, it is required to update the remaining engine oil life. If the replacement module is not programmed with the remaining engine oil life, the engine oil life will default to 100%. If the replacement module is not programmed with the remaining engine oil life, the engine oil will need to be changed at 5000 km (3,000 mi) from the last engine oil change.

5. Program the ECM. Refer to Engine Control Module Programming and Setup.
6. If you encounter an ECM programming error, with a display message of "Starting Disabled, Remove Key" on the driver information center, with a diagnostic test code (DTC) of P1631, perform the "10-Minute Relearn Procedure" found in Programming Theft Deterrent Control Module Programming and Setup. Refer to Theft Deterrent Control Module Programming and Setup.
7. Turn OFF the ignition for at least 5 seconds after the programming event is complete.
8. Perform the throttle learn procedure. Refer to Throttle Learn.
9. Use the scan tool to clear all DTCs.

Throttle Learn

Description

The engine control module (ECM) learns the idle position of the throttle body to ensure the correct idle operation. Anytime the ECM or the throttle body is replaced, the ECM must learn the idle position. The engine idle may be unstable or a DTC may set if the idle position is not learned.

Conditions for Running the Idle Learn Procedure

- DTCs P0121, P0122, P0123, P0221, P0222, P0223, P0638, P2100, P2101, P2105, and P2119 are not set.
- The engine speed is less than 40 RPM.
- The vehicle speed is 0 km/h (0 mph).
- The accelerator pedal position is less than 14.9 percent.
- The ignition 1 voltage is more than 10 volts.
- The engine coolant temperature is between 5-85°C (41-185°F).
- The intake air temperature is between 5-60°C (41-140°F).

Idle Learn Procedure

Note:

- Ensure the above conditions are met before performing with this procedure.
- Do not perform this procedure if a throttle position (TP) sensor or other throttle actuator control (TAC) system DTCs are set other than P2176. The ECM will not perform the idle learn procedure with a DTC set.

1. Turn OFF the ignition for 30 seconds.
2. Turn ON the ignition, with the engine OFF for 60 seconds.
3. Turn OFF the ignition.
4. Turn ON the ignition, with the engine OFF.
5. Clear the DTCs with a scan tool.

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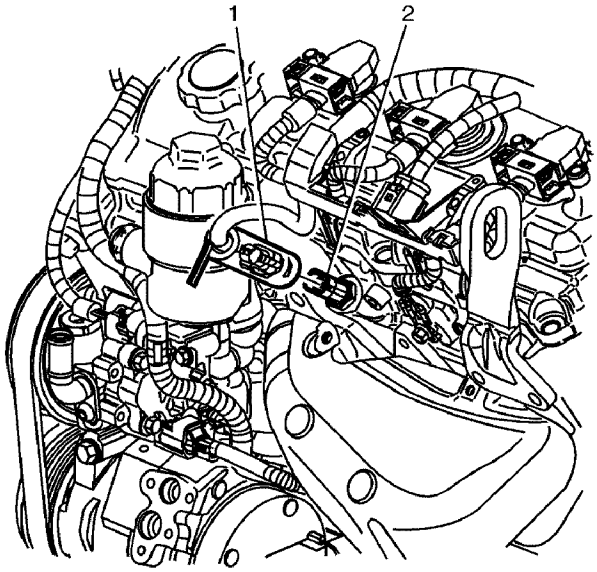
Engine Coolant Temperature Sensor Replacement

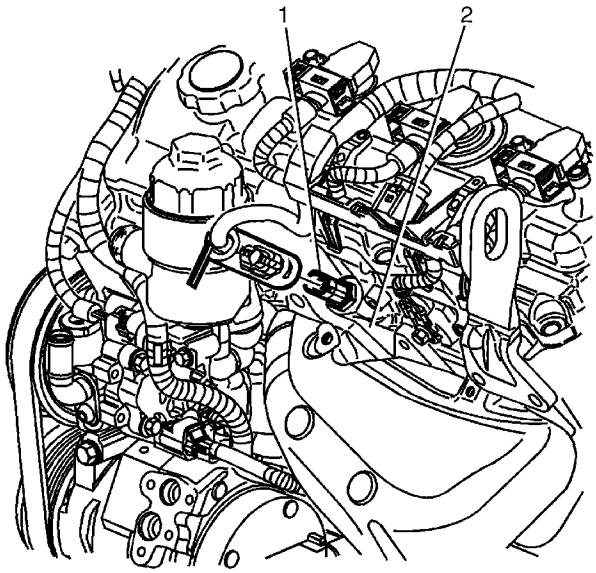
Removal Procedure

Warning: Allow sufficient time for the engine to cool before removing the ECT sensor. A hot engine may cause an excessive coolant loss or a personal injury.

1. Turn the ignition OFF.



2. Remove the engine coolant temperature sensor harness connector (1) from the coolant temperature sensor (2).



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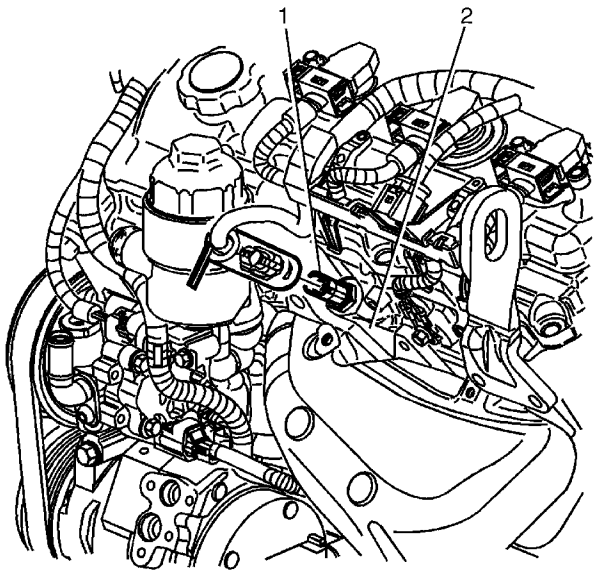
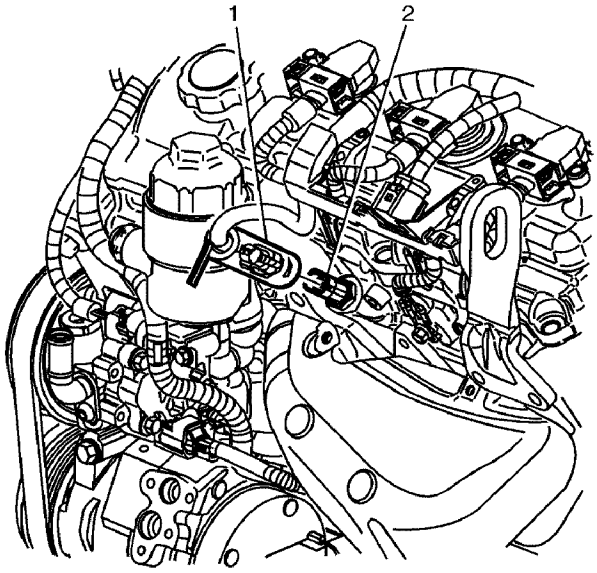
3. Remove the engine coolant temperature sensor (1) from the engine (2).

Installation Procedure

Caution: Refer to Fastener Caution in the Preface section.



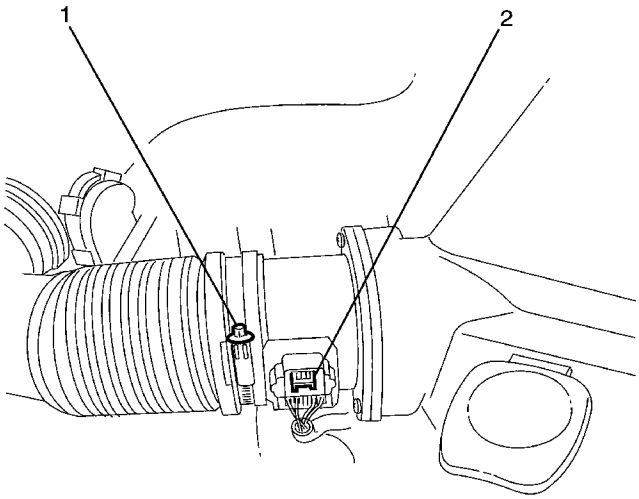
1. Install the coolant temperature sensor (1) to the engine and tighten to **22 N·m (16 lb ft)**.



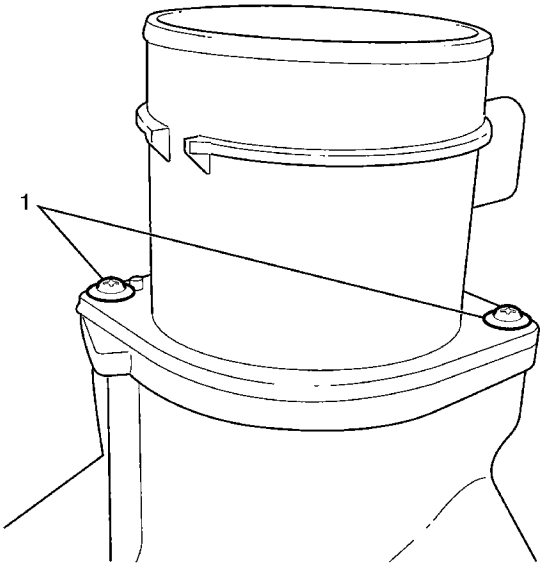
2. Install the coolant temperature sensor electrical connector (1) to the coolant temperature sensor.
3. Inspect and fill the cooling system as necessary. Refer to Cooling System Draining and Filling.

Mass Airflow Sensor with Intake Air Temperature Sensor Replacement

Removal Procedure



1. Ignition OFF.
2. Remove the air cleaner intake duct. Refer to Air Cleaner Inlet Duct Replacement.
3. Remove the mass air flow (MAF) harness connector (2) from the MAF sensor.
4. Remove the MAF sensor air box retaining clamps (1).



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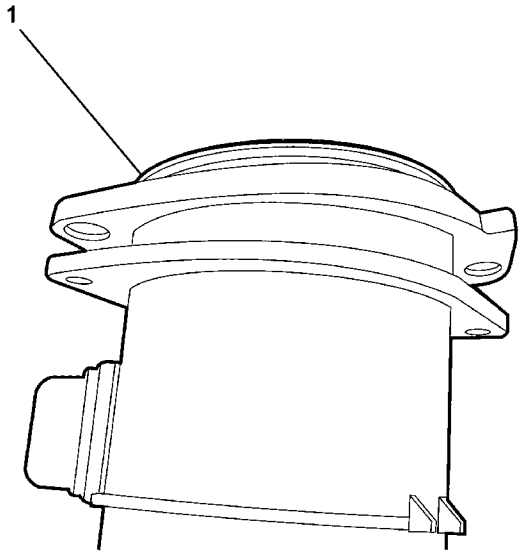
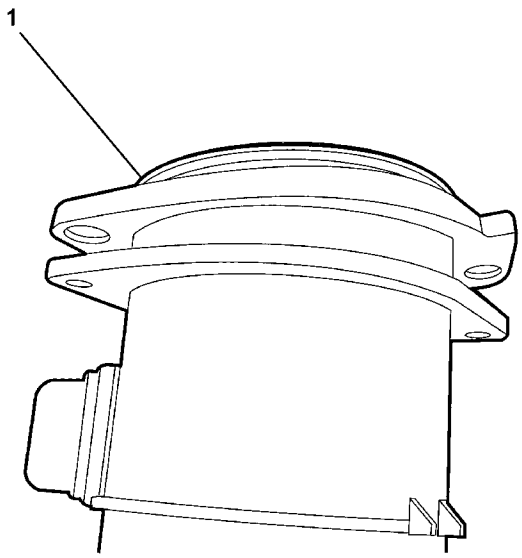
5. Remove the MAF sensor to air box retaining screws (1).



6. Remove the MAF sensor seal and discard the seal.

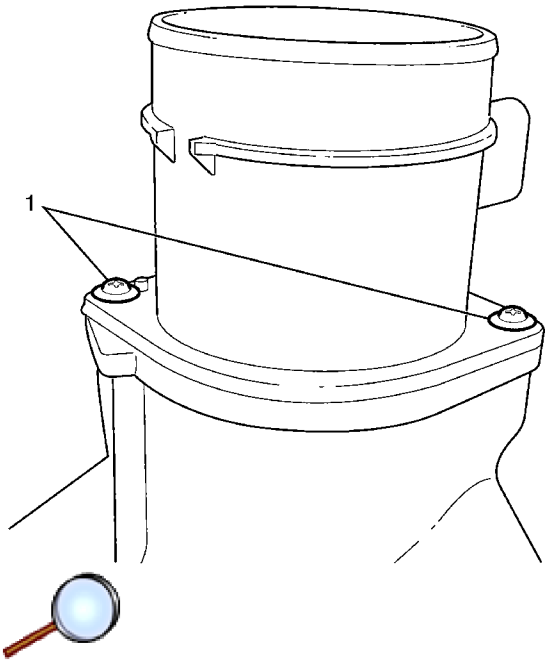
Installation Procedure



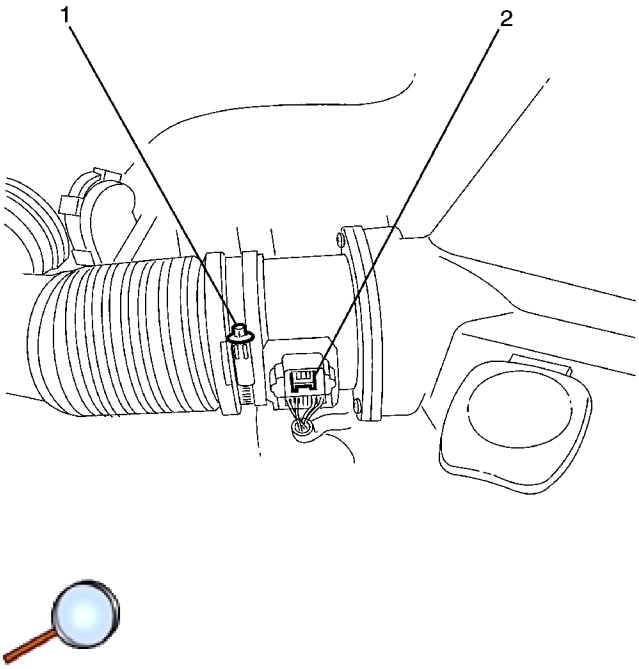
Note: Make note of the MAF sensor orientation when fitting to the air induction tube ensuring, arrow pointing toward the engine.

1. Install the new MAF sensor seal (1) locating the seal in the location holes and the MAF sensor.

   Caution: Refer to Fastener Caution in the Preface section.



2. Install the MAF sensor to air box retaining screws (1) and tighten to **4 N·m (35 lb in)**.



3. Install the air cleaner intake duct. Refer to Air Cleaner Inlet Duct Replacement.
4. Install the mass air flow (MAF) harness connector (2).
5. Install the MAF sensor clamps (1) to the MAF sensor.

Heated Oxygen Sensor Replacement - Bank 1 Sensor 1

Removal Procedure

Warning: Refer to Exhaust Service Warning in the Preface section.

Warning: Refer to Protective Goggles and Glove Warning in the Preface section.

Caution: The Heated Oxygen Sensor (HO2S) and the Oxygen Sensor use a permanently attached pigtail and connector. Do not remove this pigtail from the Heated Oxygen Sensor. Damage or the removal of the pigtail or the connector could affect the proper operation of the sensor.

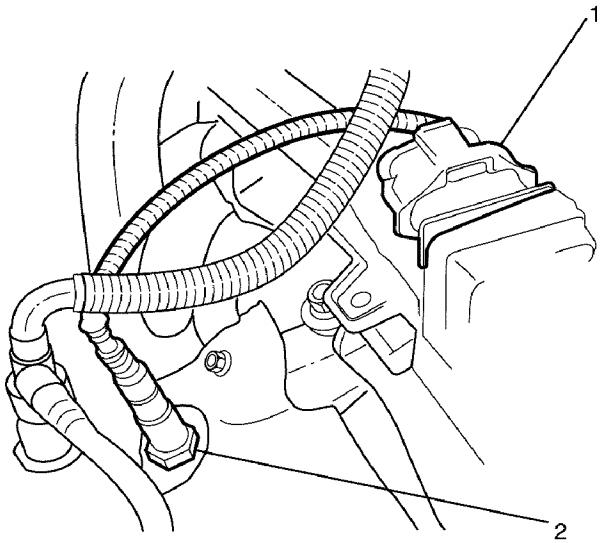
Take care when handling the HO2S and the O2S. Keep the in-line electrical connector and the louvered end free of grease, dirt, or other contaminants. Also avoid using cleaning solvents of any type. Do not drop the HO2S or the O2S. Do not roughly handle the HO2S or the O2S.

Caution: Remove oxygen sensors with the engine temperature above 48°C (120°F). Otherwise the oxygen sensors may be difficult to remove.

1. Ignition OFF.

Warning: Refer to Battery Disconnect Warning in the Preface section.

2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.
3. Remove the engine cover. Refer to Engine Cover Replacement.



4. Disconnect the heated oxygen sensor (HO2S) electrical connector (1).

Caution: Handle the oxygen sensors carefully in order to prevent damage to the component.

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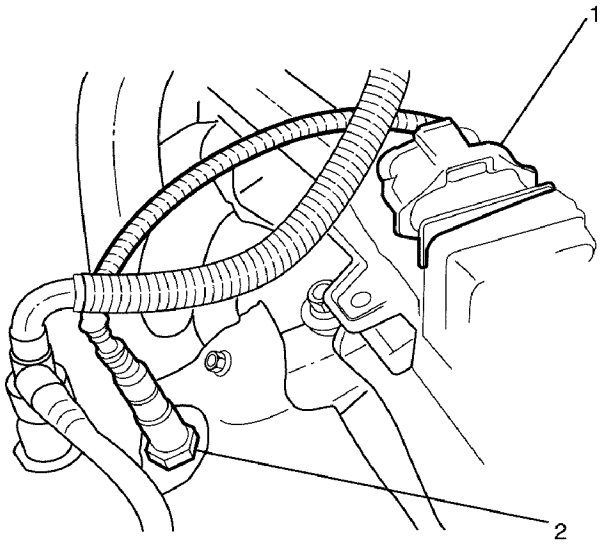
Keep the electrical connector and the exhaust inlet end free of contaminants. Do not use cleaning solvents on the sensor. Do not drop or mishandle the sensor.

5. Remove the HO2S (2) from the exhaust manifold.

Installation Procedure



Caution: A special anti-seize compound is used on the oxygen sensor threads. New service sensors should already have the compound applied to the threads. Coat the threads of a reused sensor with anti-seize compound P/N 5613695 or equivalent.

1. Install the HO2S (2) into the exhaust manifold and tighten to **42 N·m (31 lb ft)**.
2. Connect the HO2S electrical connector (1).
3. Install the engine cover. Refer to Engine Cover Replacement.
4. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection .

Heated Oxygen Sensor Replacement - Bank 1 Sensor 2

Removal Procedure

Warning: Refer to Exhaust Service Warning in the Preface section.

Warning: Refer to Protective Goggles and Glove Warning in the Preface section.

Caution: The Heated Oxygen Sensor (HO2S) and the Oxygen Sensor use a permanently attached pigtail and connector. Do not remove this pigtail from the Heated Oxygen Sensor. Damage or the removal of the pigtail or the connector could affect the proper operation of the sensor.

Take care when handling the HO2S and the O2S. Keep the in-line electrical connector and the louvered end free of grease, dirt, or other contaminants. Also avoid using cleaning solvents of any type. Do not drop the HO2S or the O2S. Do not roughly handle the HO2S or the O2S.

Caution: Remove oxygen sensors with the engine temperature above 48°C (120°F). Otherwise the oxygen sensors may be difficult to remove.

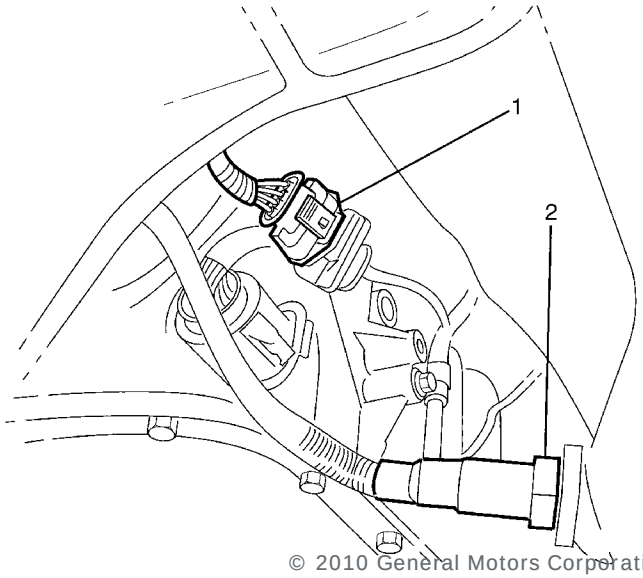
1. Ignition OFF.

   Warning: Refer to Battery Disconnect Warning in the Preface section.

2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

   Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

3. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.



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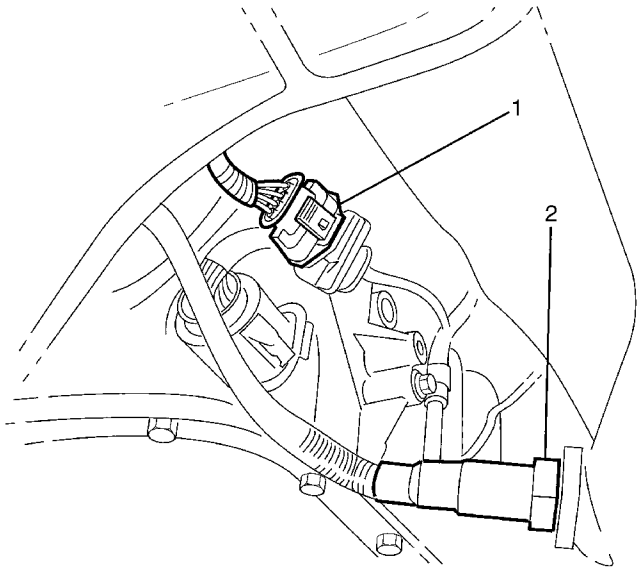
4. Disconnect the heated oxygen sensor (HO2S) electrical connector (1).

Caution: Handle the oxygen sensors carefully in order to prevent damage to the component. Keep the electrical connector and the exhaust inlet end free of contaminants. Do not use cleaning solvents on the sensor. Do not drop or mishandle the sensor.

5. Remove the HO2S (2) from the exhaust crossover pipe assembly.

Installation Procedure



Caution: A special anti-seize compound is used on the oxygen sensor threads. New service sensors should already have the compound applied to the threads. Coat the threads of a reused sensor with anti-seize compound P/N 5613695 or equivalent.

1. Install the HO2S (2) to the exhaust crossover pipe assembly and tighten to **42 N·m (31 lb ft)**.
2. Connect the HO2S electrical connector (1).
3. Lower the vehicle.
4. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

Heated Oxygen Sensor Replacement - Bank 2 Sensor 1

Removal Procedure

Warning: Refer to Exhaust Service Warning in the Preface section.

Warning: Refer to Protective Goggles and Glove Warning in the Preface section.

Caution: The Heated Oxygen Sensor (HO2S) and the Oxygen Sensor use a permanently attached pigtail and connector. Do not remove this pigtail from the Heated Oxygen Sensor. Damage or the removal of the pigtail or the connector could affect the proper operation of the sensor.

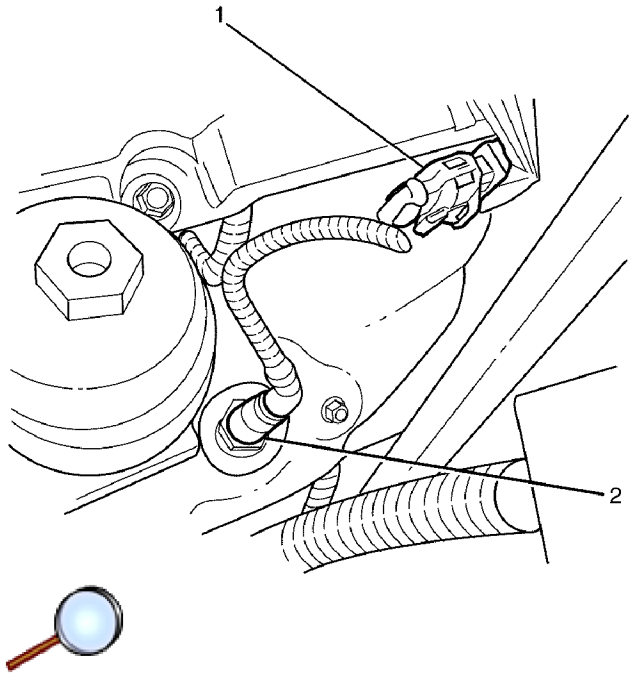
Take care when handling the HO2S and the O2S. Keep the in-line electrical connector and the louvered end free of grease, dirt, or other contaminants. Also avoid using cleaning solvents of any type. Do not drop the HO2S or the O2S. Do not roughly handle the HO2S or the O2S.

Caution: Remove oxygen sensors with the engine temperature above 48°C (120°F). Otherwise the oxygen sensors may be difficult to remove.

1. Ignition OFF.

Warning: Refer to Battery Disconnect Warning in the Preface section.

2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.
3. Remove the engine cover. Refer to Engine Cover Replacement.



4. Disconnect the heated oxygen sensor (HO2S) electrical connector (1).

Caution: Handle the oxygen sensors carefully in order to prevent damage to the component.

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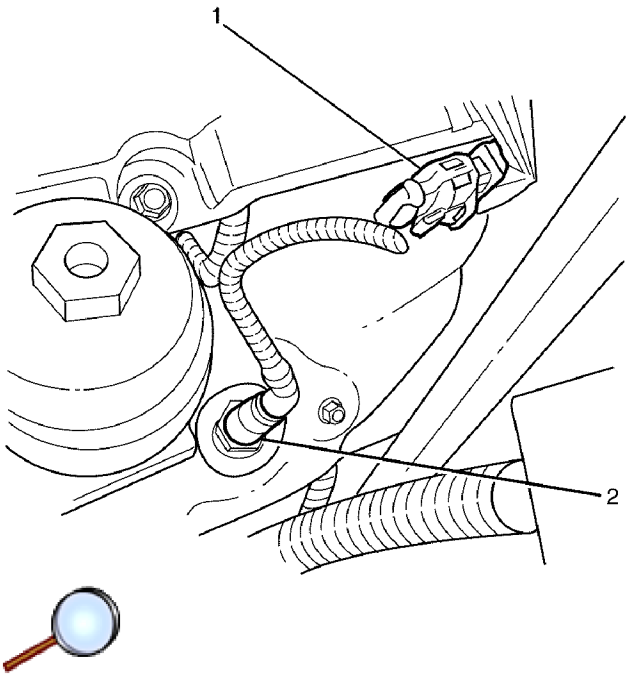
Keep the electrical connector and the exhaust inlet end free of contaminants. Do not use cleaning solvents on the sensor. Do not drop or mishandle the sensor.

5. Remove the HO2S (2) from the exhaust manifold.

Installation Procedure



Caution: A special anti-seize compound is used on the oxygen sensor threads. New service sensors should already have the compound applied to the threads. Coat the threads of a reused sensor with anti-seize compound P/N 5613695 or equivalent.

1. Install the HO2S (2) into the exhaust manifold and tighten to **42 N·m (31 lb ft)**.
2. Connect the HO2S electrical connector (1).
3. Install the engine cover. Refer to Engine Cover Replacement.
4. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection .

Heated Oxygen Sensor Replacement - Bank 2 Sensor 2

Removal Procedure

Warning: Refer to Exhaust Service Warning in the Preface section.

Warning: Refer to Protective Goggles and Glove Warning in the Preface section.

Caution: The Heated Oxygen Sensor (HO2S) and the Oxygen Sensor use a permanently attached pigtail and connector. Do not remove this pigtail from the Heated Oxygen Sensor. Damage or the removal of the pigtail or the connector could affect the proper operation of the sensor.

Take care when handling the HO2S and the O2S. Keep the in-line electrical connector and the louvered end free of grease, dirt, or other contaminants. Also avoid using cleaning solvents of any type. Do not drop the HO2S or the O2S. Do not roughly handle the HO2S or the O2S.

Caution: Remove oxygen sensors with the engine temperature above 48°C (120°F). Otherwise the oxygen sensors may be difficult to remove.

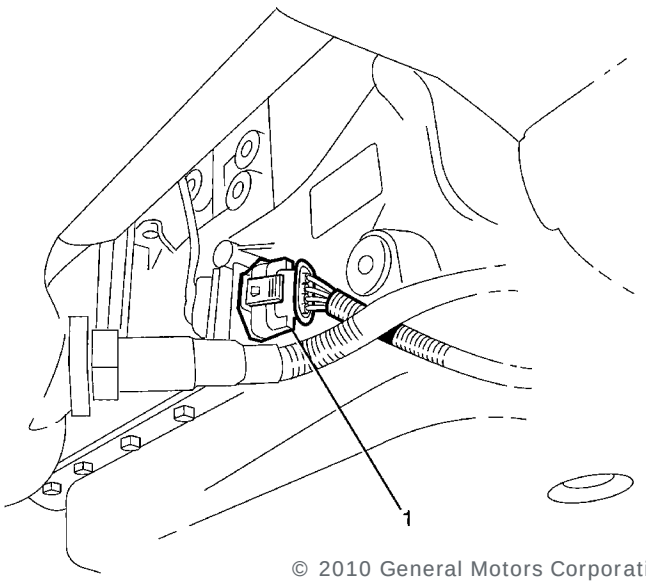
1. Ignition OFF.

   Warning: Refer to Battery Disconnect Warning in the Preface section.

2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

   Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

3. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.



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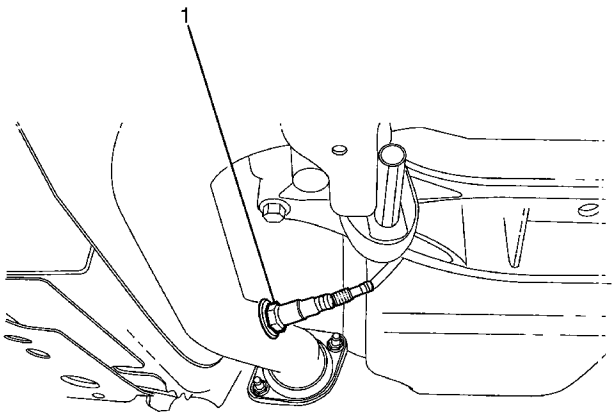
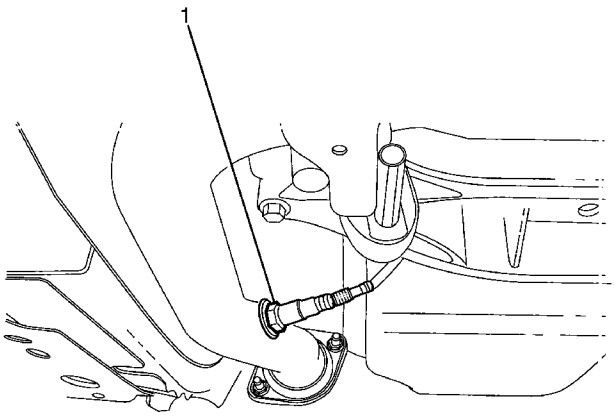
4. Disconnect the heated oxygen sensor (HO2S) electrical connector (1).



Caution: Handle the oxygen sensors carefully in order to prevent damage to the component. Keep the electrical connector and the exhaust inlet end free of contaminants. Do not use cleaning solvents on the sensor. Do not drop or mishandle the sensor.

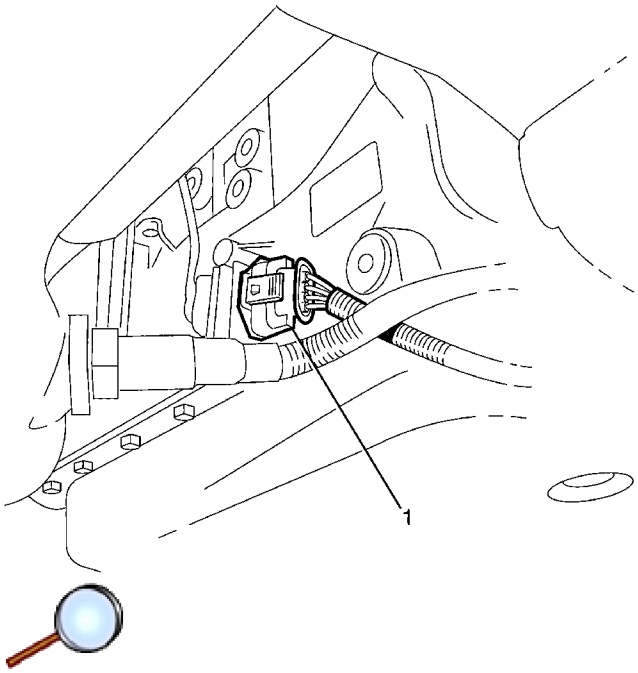
5. Remove the HO2S (2) from the exhaust crossover pipe assembly.

Installation Procedure



Caution: A special anti-seize compound is used on the oxygen sensor threads. New service sensors should already have the compound applied to the threads. Coat the threads of a reused sensor with anti-seize compound P/N 5613695 or equivalent.

1. Install the HO2S (2) to the exhaust crossover pipe assembly and tighten to **42 N·m (31 lb ft)**.

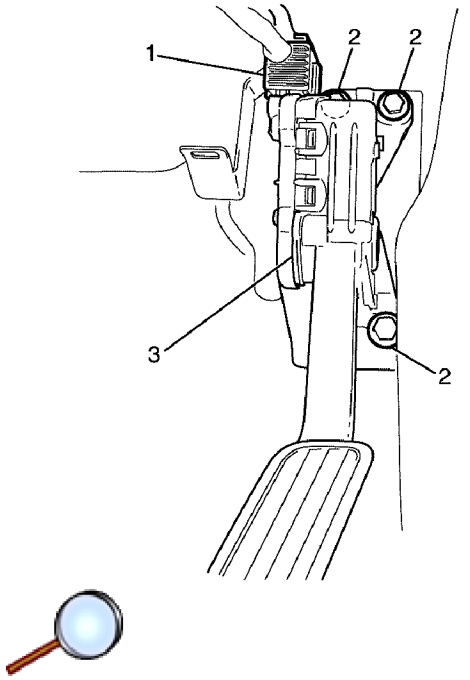


2. Connect the HO2S electrical connector (1).
3. Lower the vehicle.
4. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

Accelerator Pedal Position Sensor Replacement

Removal Procedure

1. Remove the closeout/insulator panel. Refer to Instrument Panel Insulator Panel Replacement - Left Side.



Caution: Handle the electronic throttle control components carefully. Use cleanliness in order to prevent damage. Do not drop the electronic throttle control components. Do not roughly handle the electronic throttle control components. Do not immerse the electronic throttle control components in cleaning solvents of any type.

2. Disconnect the accelerator pedal position (APP) sensor electrical connector (1).
3. Remove the APP sensor to vehicle retaining screws (2).
4. Remove the APP sensor (3) from the vehicle.

Installation Procedure

Caution: Refer to Fastener Caution in the Preface section.

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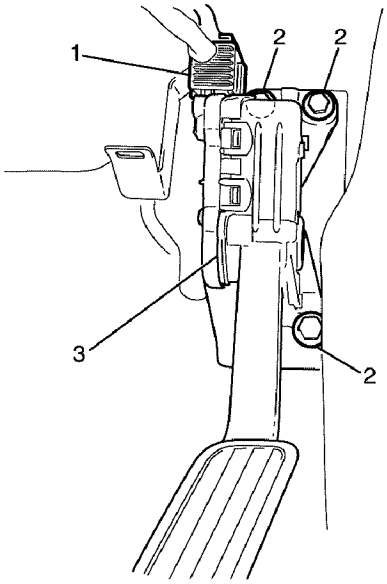
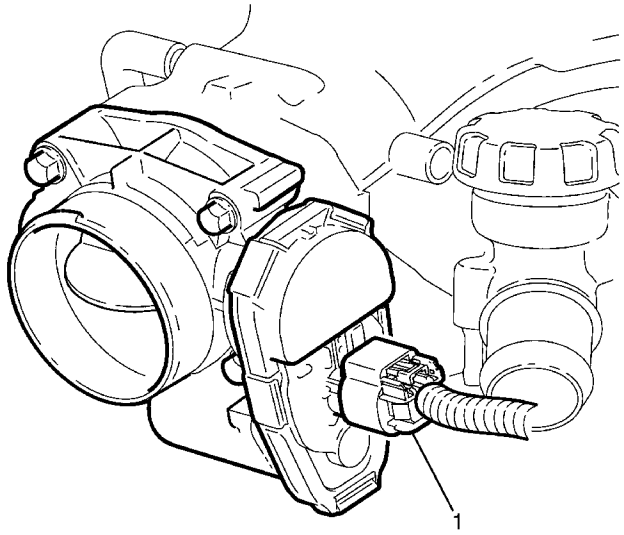


1. Install the APP sensor (3) to the vehicle and tighten the bracket screws (2) to **9 N·m (80 lb in)**.
2. Connect the APP sensor electrical connector (1).
3. Operate the accelerator pedal and observe the APP angles using a scan tool. The accelerator pedal should operate freely, without binding between closed throttle and wide open throttle.
4. Install the closeout/insulator panel. Refer to Instrument Panel Insulator Panel Replacement - Left Side.

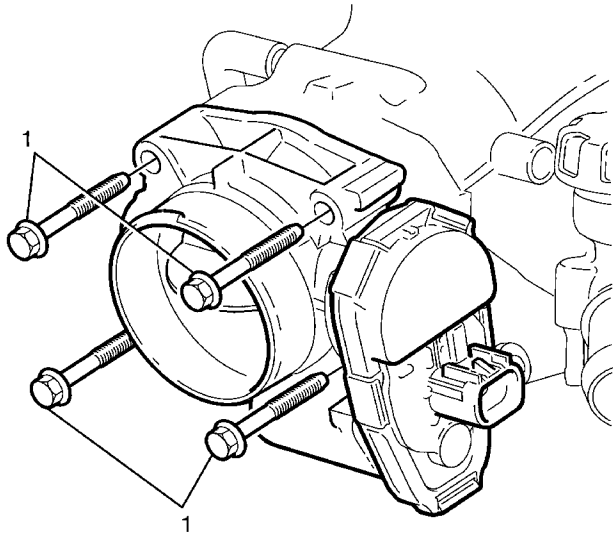
Throttle Body Assembly Replacement

Removal Procedure

1. Turn the ignition OFF.
2. Remove the air cleaner intake duct. Refer to Air Cleaner Inlet Duct Replacement.



3. Remove the throttle body electrical connector (1) from the throttle body.



4. Remove the throttle body bolts to upper intake manifold retaining bolts (1).
5. Remove the throttle body and gasket from the vehicle.

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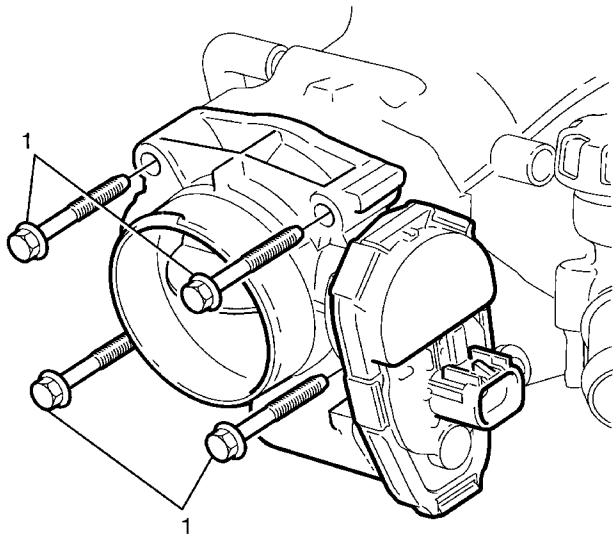
Installation Procedure

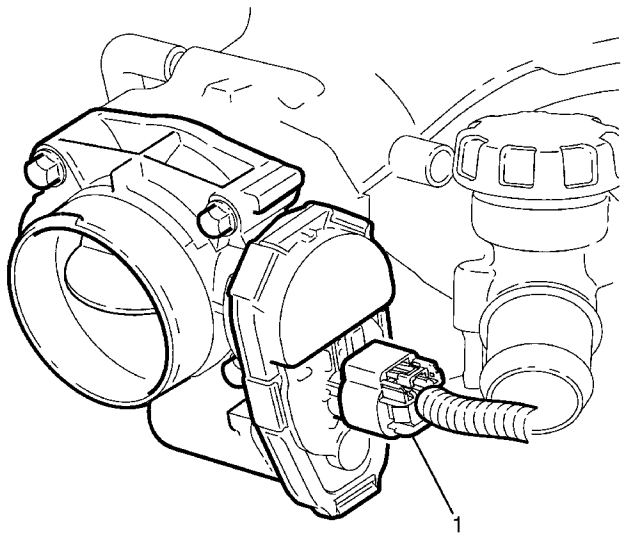
1. Carefully clean the throttle body mounting surfaces of any gasket and/or sealing material.



2. Install the throttle body and NEW gasket to the vehicle.

   Caution: Refer to Fastener Caution in the Preface section.

3. Install the throttle body bolts to upper intake manifold retaining bolts (1) and tighten to **10 N·m (89 lb in)**.



4. Install the throttle body electrical connector (1) to the throttle body.
5. Install the air cleaner intake duct. Refer to Air Cleaner Inlet Duct Replacement.
6. Perform the throttle learn procedure. Refer to Throttle Learn.
7. Use the scan tool to clear all DTCs.

Throttle Body Inspection and Cleaning

Warning: Refer to Safety Glasses Warning in the Preface section.

1. Remove the air cleaner intake duct. Refer to Air Cleaner Inlet Duct Replacement.
2. Fully open the throttle valve in order to Inspect the throttle body bore and the throttle valve plate for any deposits.

Caution: Do not subject a throttle body assembly which contains the following components to an immersion cleaner or a strong solvent:

- Throttle position (TP) sensor
- Idle air control (IAC) valve
- Sealed throttle shaft bearings

The cleaners will damage the electric components or sensors.

The cleaners will damage some of these components that contain seals or O-rings.

Solvents can wash away or break down the grease used on non-serviceable throttle shaft bearings.

Never use a wire brush or scraper to clean the throttle body. A wire brush or sharp tools may damage the throttle body components.

Do not use a cleaner that contains methyl ethyl ketone. This extremely strong solvent may damage components and is not necessary for this type of cleaning.

3. Use a clean shop towel and an approved Top Engine Cleaner. Clean the throttle body bore and the throttle valve plate.

   If necessary, use a parts cleaning brush in order to remove heavy deposits.

4. Install the air cleaner duct. Refer to Air Cleaner Inlet Duct Replacement.

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Fuel Pressure Relief

Special Tools

- J 34730-1A Fuel Pressure Gage
- AU-453 Fuel Pressure Test Hose Adapter

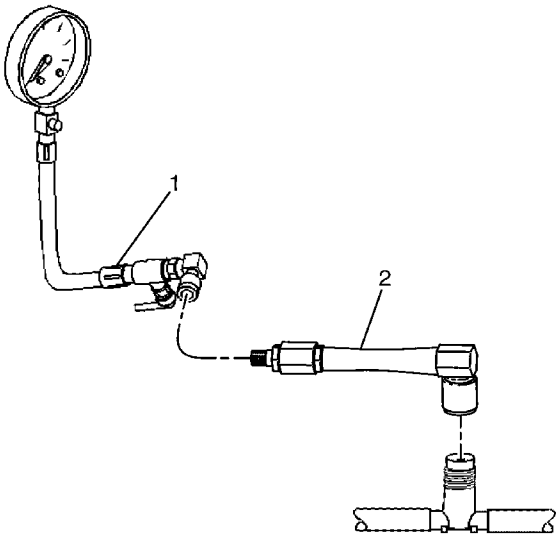
Warning: Gasoline or gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.

Warning: Relieve the fuel system pressure before servicing fuel system components in order to reduce the risk of fire and personal injury.

After relieving the system pressure, a small amount of fuel may be released when servicing the fuel lines or connections. In order to reduce the chance of personal injury, cover the regulator and the fuel line fittings with a shop towel before disconnecting. This will catch any fuel that may leak out. Place the towel in an approved container when the disconnection is complete.

Warning: Refer to Safety Glasses Warning in the Preface section.

1. Turn the ignition OFF.
2. Disconnect the negative battery cable in order to avoid possible fuel discharge if an accidental attempt is made to start the engine. Refer to Battery Negative Cable Disconnection and Connection.
3. Remove the fuel injector sight shield.



4. Connect the AU-453 (1) fuel pressure test hose adapter to the fuel pressure connection. Wrap a shop towel around the fitting while connecting the AU-453 (1) in order to avoid spillage.
5. Connect the J 34730-1A (2) fuel pressure gage to the AU-453 (1). Wrap a shop towel

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around the fitting while connecting the gage in order to avoid spillage.
6. Install the bleed hose into an approved container.
7. Open the valve in order to bleed the system pressure. Fuel connections are now safe for servicing.
8. Drain any fuel remaining in the gage into an approved container.
9. Install the fuel injector sight shield.
10. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

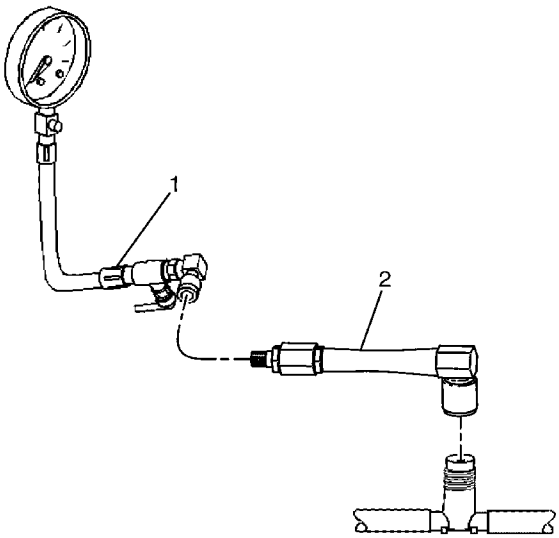
Fuel Pressure Gage Installation and Removal

Special Tools

- AU-338 Fuel Pressure Gage
- AU-465 Fuel Pressure Gage Hose Adapter

Removal Procedure

1. Turn OFF the ignition.
2. Command the fuel pump OFF with the scan tool.
3. Open the bleed valve on the fuel pressure gage in order to bleed the remaining fuel from the fuel pressure gage.
4. Remove the bleed hose from the fuel pressure gage.



5. Disconnect the AU-338 (2) fuel pressure gage from the AU-465 (1). Wrap a shop towel around the fitting while connecting the gage in order to avoid spillage.
6. Disconnect the AU-465 (1) fuel pressure test hose adapter to the fuel pressure connection. Wrap a shop towel around the fitting while connecting the AU-465 (1) in order to avoid spillage.
7. Install the fuel pressure service connection dust cap to the fuel rail.
8. Install the engine covers. Refer to Engine Cover Replacement.

Installation Procedure

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

Caution: Clean all of the following areas before performing any disconnections in order to avoid possible contamination in the system:

- The fuel pipe connections

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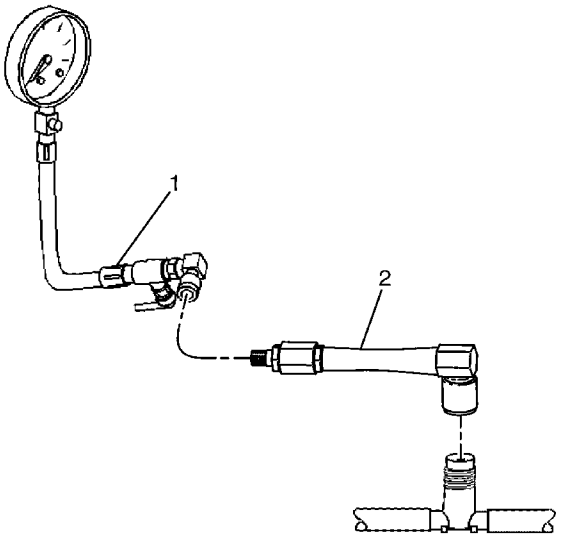
- The hose connections
- The areas surrounding the connections

1. Remove the engine covers. Refer to Engine Cover Replacement.



2. Remove the fuel pressure service connection dust cap from the fuel rail.
3. Connect the AU-465 (1) fuel pressure test hose adapter to the fuel pressure connection. Wrap a shop towel around the fitting while connecting the AU-465 (1) in order to avoid spillage.
4. Connect the AU-338 (2) fuel pressure gage to the AU-465 (1). Wrap a shop towel around the fitting while connecting the gage in order to avoid spillage.
5. Turn ON the ignition.

Warning: Do not drain the fuel into an open container. Never store the fuel in an open container due to the possibility of a fire or an explosion.

6. Place the bleed hose of the fuel pressure gage into a suitable container.
7. Open the bleed valve on the fuel pressure gage in order to bleed the air from the fuel pressure gage.
8. Command the fuel pump ON with a scan tool.
9. Close the bleed valve on the fuel pressure gage.
10. Inspect for fuel leaks.

Fuel Filter Replacement

Removal Procedure

1. Ignition OFF.

   Warning: Refer to Battery Disconnect Warning in the Preface section.

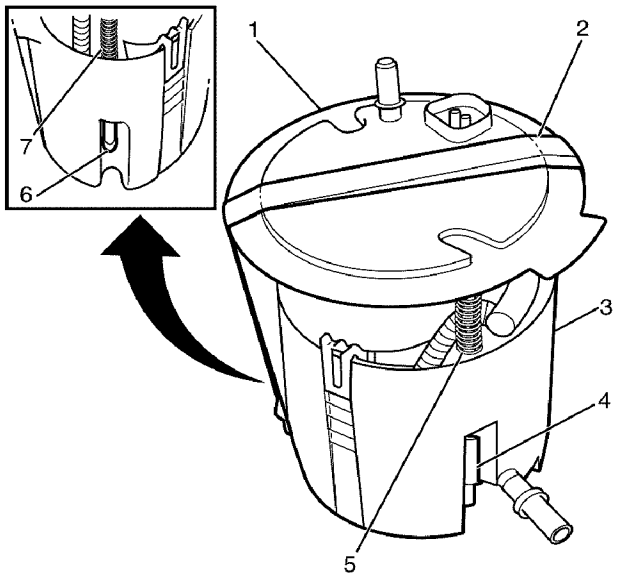
2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

   Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

   Warning: Refer to Safety Glasses Warning in the Preface section.

   Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

3. Remove the fuel tank assembly. Refer to Fuel Tank Replacement.
4. Remove the primary fuel tank module assembly from the fuel tank. Refer to Primary Fuel Tank Module Replacement.
5. Remove the fuel level sensor from the primary fuel tank module assembly. Refer to Fuel Level Sensor Replacement.



6. Carefully compress the upper half (1) and lower half (3) of the primary fuel module assembly against the spring tension and secure the upper half (1) and lower half (3) together with suitable tape (2).
7. Remove the retaining clip (4) from the primary fuel module upper half shaft (5) with a suitable tool.

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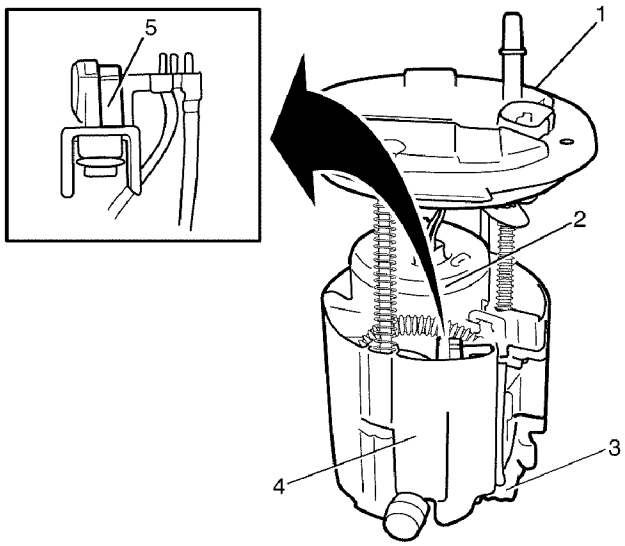
8. Remove the retaining clip (6) from the primary fuel module upper half shaft (7) with a suitable tool.



Note: Take care when removing the tape used to secure the primary fuel module upper half (1) and the primary fuel module lower half (4) together. Failure to comply may result in personal injury.

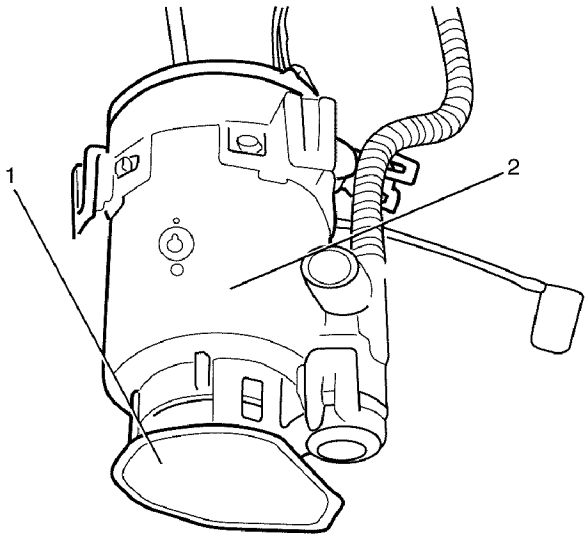
9. Remove the tape used to secure the primary fuel module upper half (1) and the primary fuel module lower half (4) together.

Note: Observe the routing of the pipes.

10. Carefully separate the upper half (1) from the lower half (4) of the primary fuel module assembly.

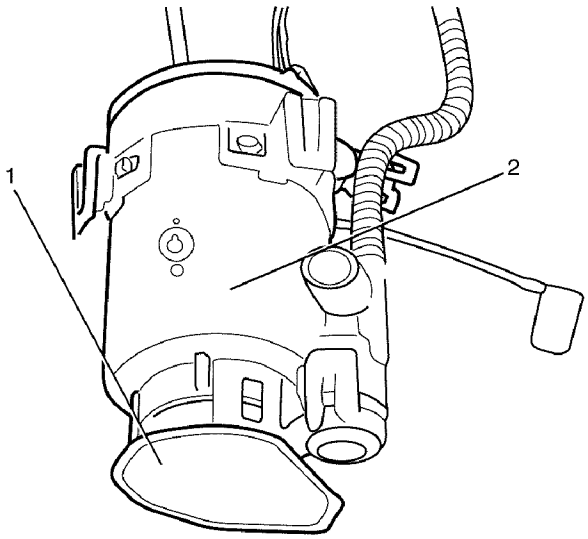
Note: Do not damage the pipe connectors.

11. Detach the pipe connector (3) with a suitable tool.
12. Detach the pipe connector (5) with a suitable tool.
13. Carefully detach and remove the fuel pump housing (2) from the primary fuel module lower half (4).



14. Detach the fuel filter (1) from the fuel pump housing (2) using a suitable tool.

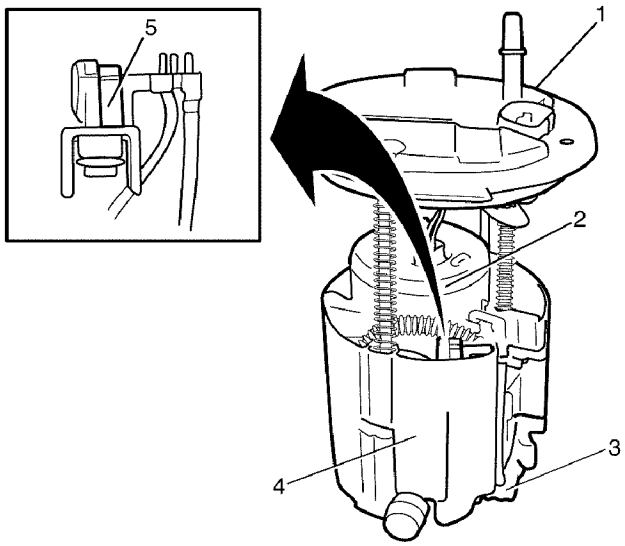
Installation Procedure



Note: Listen for audible clicks to confirm correct installation of the fuel filter (1) to the fuel pump housing (2).

Note: Make sure that all the retainers of the fuel filter (1) engages the fuel pump housing (2).

1. Install the fuel filter (1) to the fuel pump housing (2).



Note: Observe the routing of the pipes.

Note: Do not damage the pipe connectors.

Note: Listen for audible clicks to confirm correct installation of the fuel pump housing (2) to the primary fuel module lower half (4).

Note: Make sure that all the retainers of the fuel pump housing (2) engages the primary fuel module lower half (4).

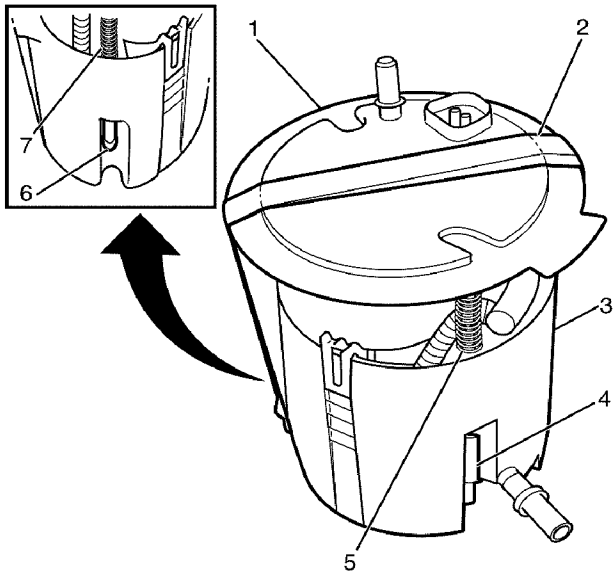
2. Carefully install the fuel pump housing (2) to the primary fuel module lower half (4).

Note: Listen for an audible click to confirm correct installation of the connector (5) to the primary fuel module lower half (4).

3. Attach the pipe connector (5) to the primary fuel module lower half (4).

Note: Listen for an audible click to confirm correct installation of the connector (3).

4. Attach the pipe connector (3) to the primary fuel module lower half (4).
5. Carefully install the upper half (1) to the lower half (3) of the primary fuel module assembly.



6. Carefully compress the upper half (1) and lower half (3) of the primary fuel module assembly against the spring tension and secure the upper half (1) and lower half (3) together with suitable tape (2).
7. Install the retaining clip (4) to the primary fuel module upper half shaft (5).
8. Install the retaining clip (6) to the primary fuel module upper half shaft (7).
9. Remove the tape used to secure the primary fuel module upper half (1) and the primary fuel module lower half (3) together.
10. Install the fuel level sensor to the primary fuel tank module assembly. Refer to Fuel Level Sensor Replacement.
11. Install the primary fuel tank module assembly to the fuel tank assembly. Refer to Primary Fuel Tank Module Replacement.
12. Install the fuel tank assembly. Refer to Fuel Tank Replacement.
13. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

Fuel Tank Draining

Draining Procedure

Warning: Refer to Safety Glasses Warning in the Preface section.

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

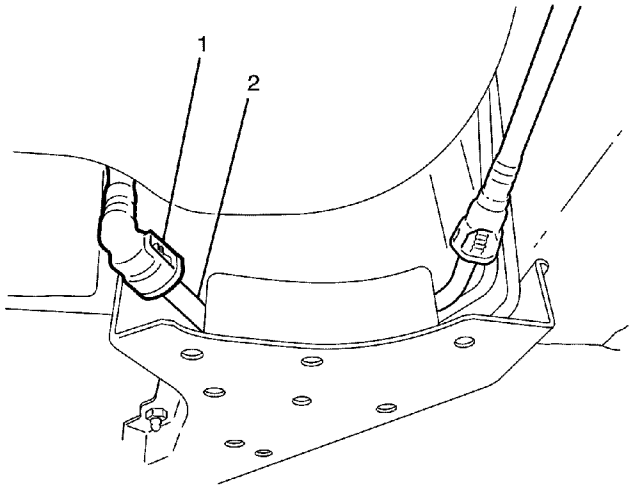
Warning: Never drain or store fuel in an open container. Always use an approved fuel storage container in order to reduce the chance of fire or explosion.

Warning: Place a dry chemical (Class B) fire extinguisher nearby before performing any on-vehicle service procedures. Failure to follow these precautions may result in personal injury.

1. Remove the fuel filler cap.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.



3. Disconnect the fuel feed line (1) from the fuel feed pipe (2). Refer to Plastic Collar Quick Connect Fitting Service.

Note: Up to 26 liters (7 gallons) of residual fuel may remain in the secondary side of the fuel tank.

4. Connect a commercially available fuel pump to the fuel feed line (1).
5. Operate the commercially available fuel pump and drain the fuel into an approved fuel

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container.

6. Disconnect the commercially available fuel pump from the fuel feed line (1).
7. If the tank is not being removed, connect the fuel feed line (1) to the fuel feed pipe (2). Refer to Plastic Collar Quick Connect Fitting Service.

Fuel Tank Replacement

Special Tools

- EN-46843
- 7370
- 7371
- EN-48536

Removal Procedure

1. Ignition OFF.

   Warning: Refer to Battery Disconnect Warning in the Preface section.

2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

   Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

3. Drain the fuel tank into a suitable container. Refer to Fuel Tank Draining.

   Warning: Refer to Safety Glasses Warning in the Preface section.

   Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

4. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
5. Remove the right rear wheel. Refer to Tire and Wheel Removal and Installation.
6. Remove the exhaust system for access. Refer to Exhaust System Replacement.
7. Remove the propeller shaft. Refer to Propeller Shaft Replacement.
8. Remove the park brake cables. Refer to Parking Brake Rear Cable Replacement.

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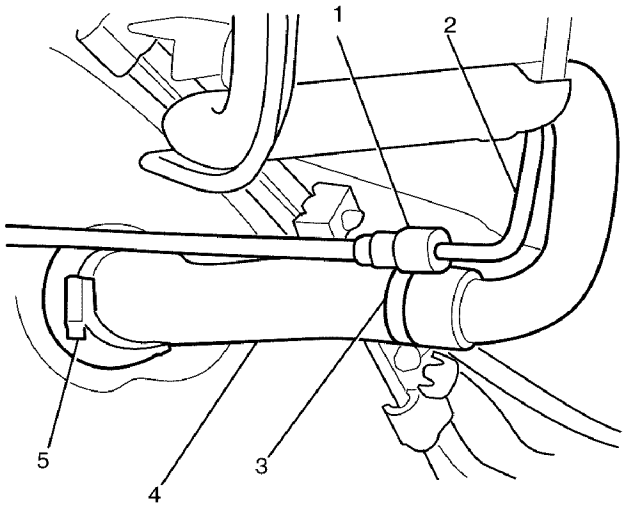
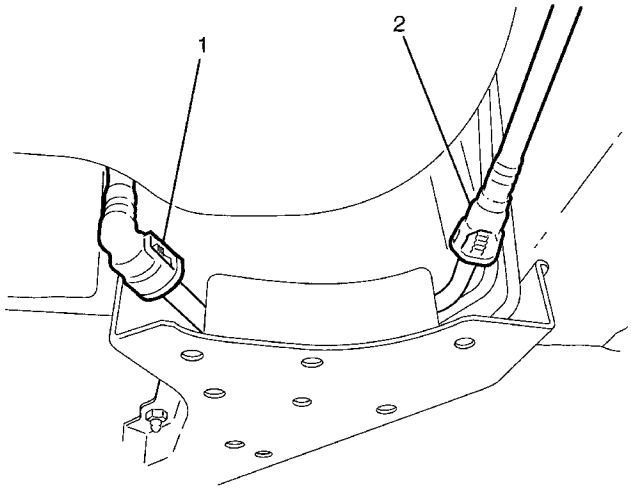
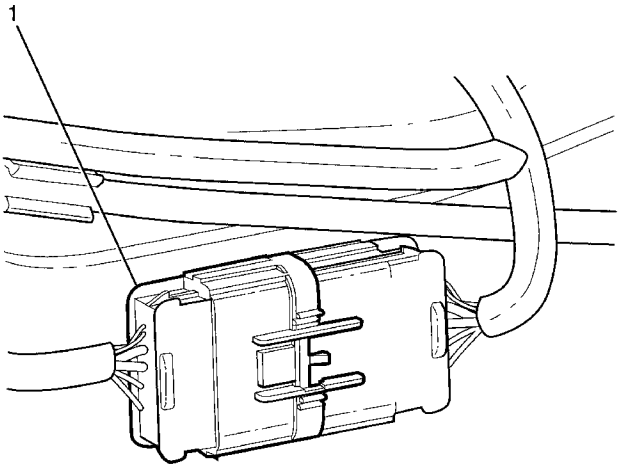


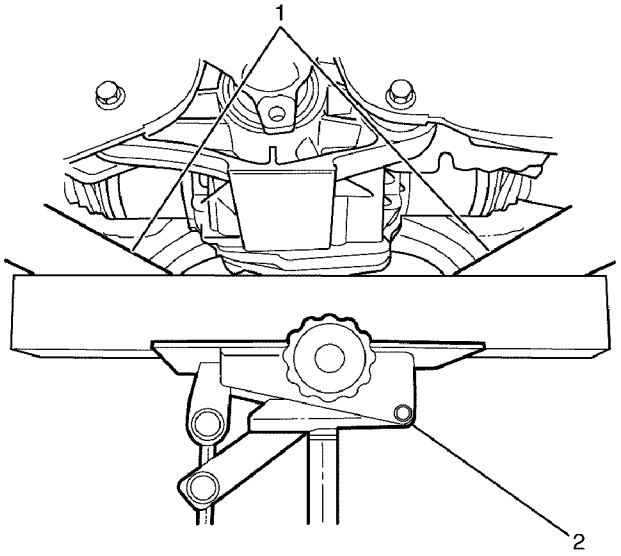
9. Disconnect the lower evaporative emission (EVAP) line (1) from the upper EVAP line (2). Refer to Plastic Collar Quick Connect Fitting Service.
10. Remove the retaining hose clamp (3) from the fuel filler hose (4).
11. Remove the retaining hose clamp (5) from the fuel filler hose (4).
12. Remove the fuel filler hose (4) from the vehicle.



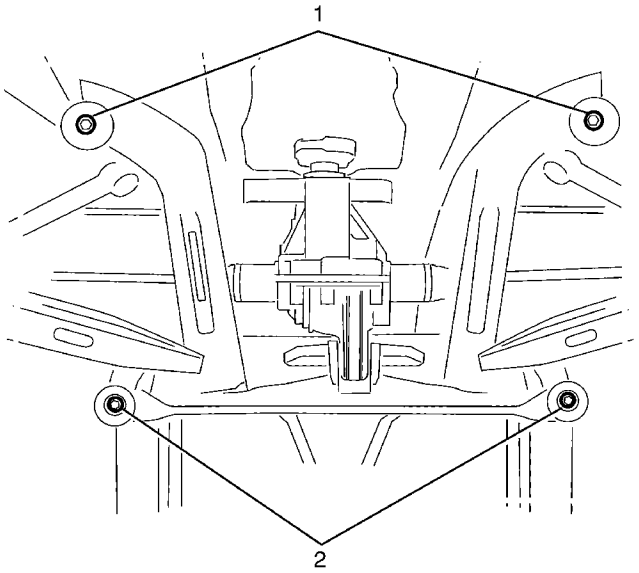
13. Disconnect the fuel feed line (1) using 7371
14. Disconnect the EVAP line (2). Refer to Plastic Collar Quick Connect Fitting Service.



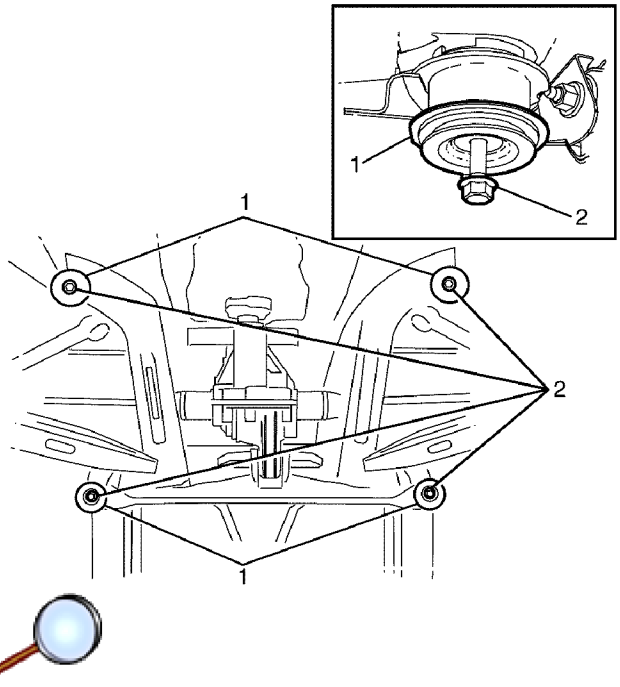
15. Disconnect the fuel tank electrical connector (1) from the chassis electrical harness.



16. Support the rear frame assembly (1) using a suitable tool (2).



17. Remove the rear frame to chassis retaining bolts (1) and discard.
18. Remove the rear frame to chassis retaining bolts (2) and discard.

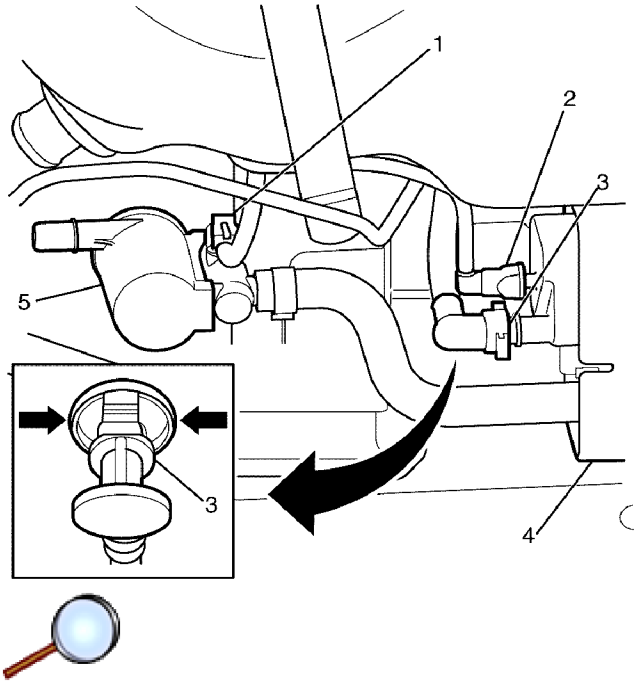


Note: Make sure that the bolts (2) extends 50mm (2 in) from the rear frame.

19. Install the bolts (2) of EN-48536 to the rear frame mounts (1).

Note: When lowering the rear frame do not to damage the rear brake hoses.

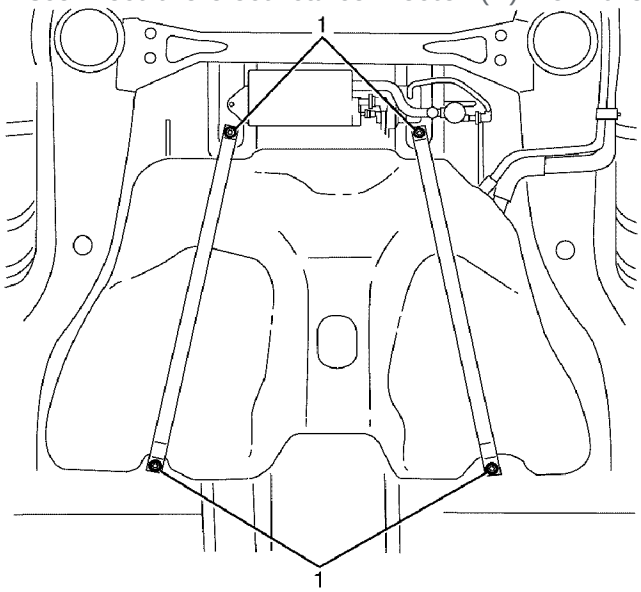
20. Lower the rear frame onto the bolts (2) of EN-48536 .



21. Detach the EVAP canister hose connector (2) from the EVAP canister (4). Refer to Plastic Collar Quick Connect Fitting Service.

Note: Squeezes the collar of the EVAP canister hose connector (3) to release the connector.

22. Detach the EVAP canister hose connector (3) from the EVAP canister (4).
23. Disconnect the electrical connector (1) from the EVAP canister vent solenoid (5).



Note: Take care not to damage the following components when lowering the fuel tank assembly.

- The fuel tank assembly wiring harness.
- The fuel feed pipe.

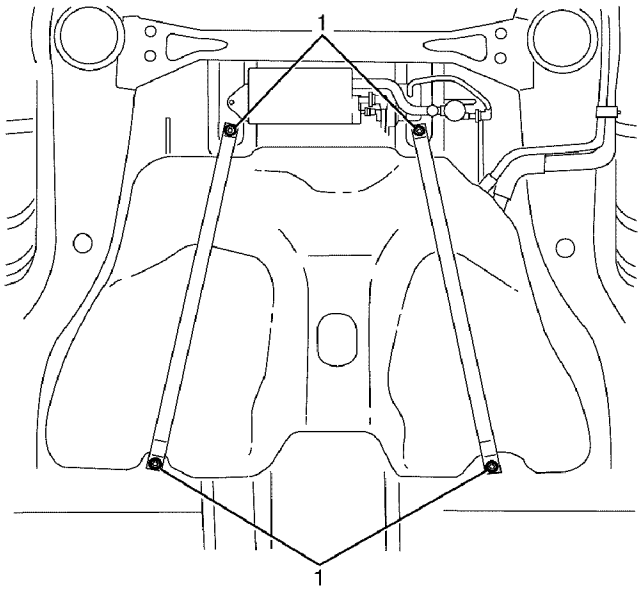
- The EVAP pipes.

Note: Support the fuel tank assembly with a suitable tool before removing the fuel tank assembly straps to chassis retaining bolts (1)

24. Remove the fuel tank strap to chassis retaining bolts (1).
25. With the aid of an assistant, carefully manoeuvre the fuel tank assembly from the vehicle.
26. Remove the following components if replacing the fuel tank:
    - The primary fuel tank module--Refer to Primary Fuel Tank Module Replacement.
    - The secondary fuel tank module--Refer to Secondary Fuel Tank Module Replacement.
    - The fuel tank pressure sensor. Refer to Fuel Tank Pressure Sensor Replacement.
    - The fuel tank assembly electrical harness.
    - The fuel tank EVAP pipes.

Installation Procedure

1. If the fuel tank was replaced, install the following components:
    - The primary fuel tank module--Refer to Primary Fuel Tank Module Replacement.
    - The secondary fuel tank module--Refer to Secondary Fuel Tank Module Replacement.
    - The fuel tank pressure sensor. Refer to Fuel Tank Pressure Sensor Replacement.
    - The fuel tank assembly electrical harness.
    - The fuel tank EVAP pipes.



Note: Take care not to damage the following components when installing the fuel tank assembly to the vehicle:

- The fuel tank assembly wiring harness.
- The fuel feed pipe.

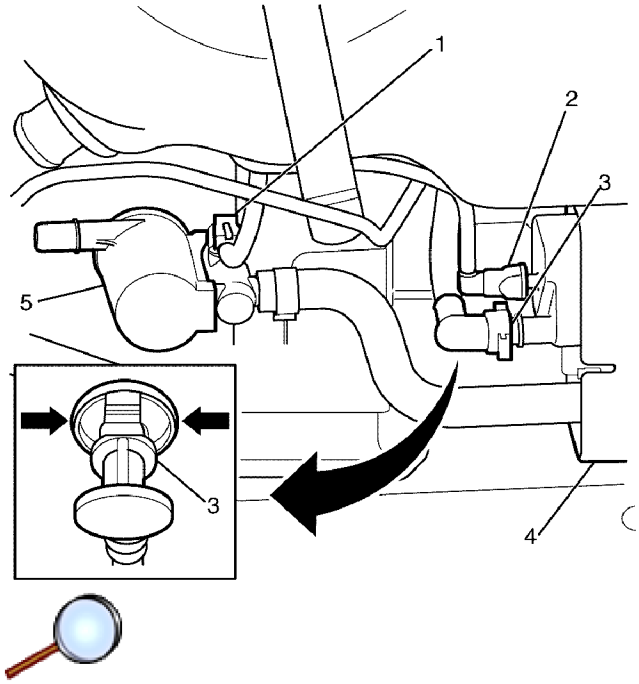
- The Evap pipes.

Note: Support the fuel tank assembly with a suitable tool while installing the fuel tank assembly straps to chassis retaining bolts (1).

2. With the aid of an assistant, carefully manoeuvre and install the fuel tank assembly to the vehicle.

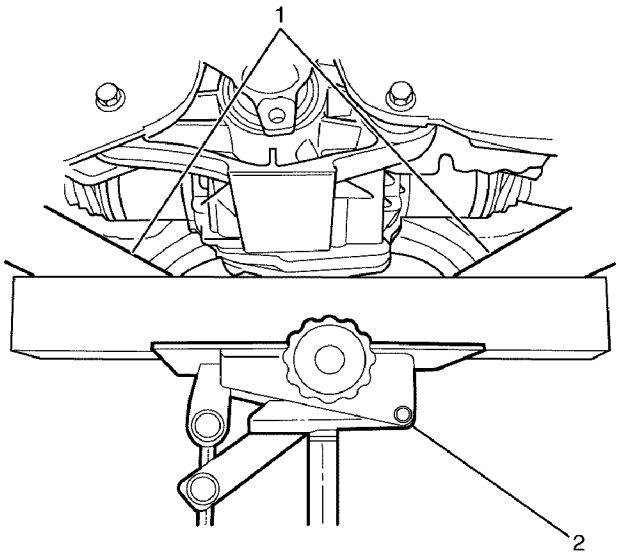
Caution: Refer to Fastener Caution in the Preface section.

3. Install the fuel tank assembly strap to chassis retaining bolts (1) and tighten to **20 N·m (15 lb ft)**.

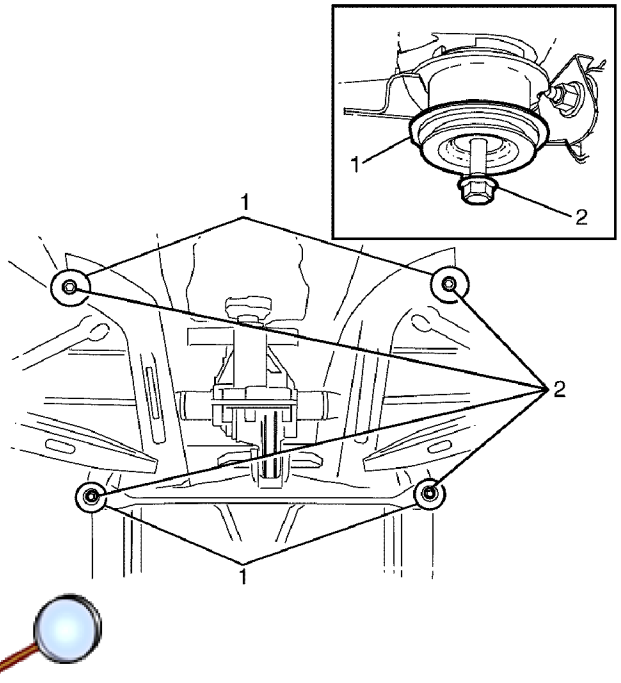


Note: Listen for an audible click to confirm correct installation.

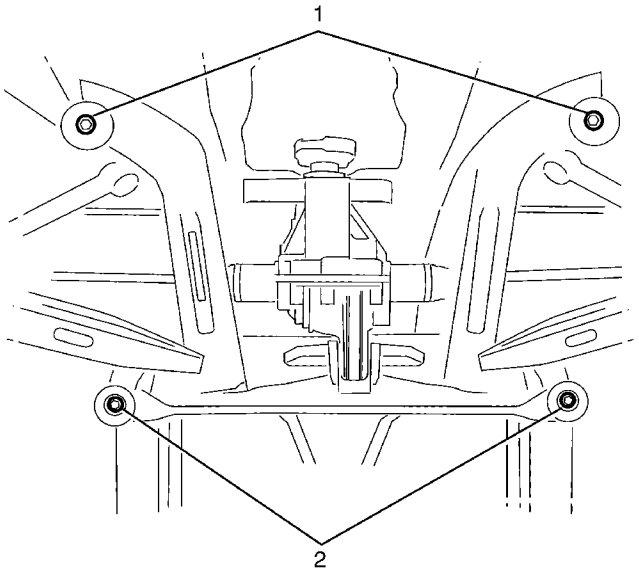
4. Connect the electrical connector (1) to the EVAP emission canister vent solenoid (5).
5. Attach the EVAP canister hose connector (2) to the EVAP canister (4). Refer to Plastic Collar Quick Connect Fitting Service.
6. Attach the EVAP canister hose connector (3) to the EVAP canister (4).



7. Raise and support the rear frame assembly (1) into its position using a suitable tool (2).



8. Remove the bolts (2) of EN-48536 from the rear frame mounts (1).



Note: Using a suitable tool clean the threaded holes of the rear frame to chassis retaining bolts.

9. Install the NEW rear frame to chassis retaining bolts (2).

   Do not fully tighten at this stage.

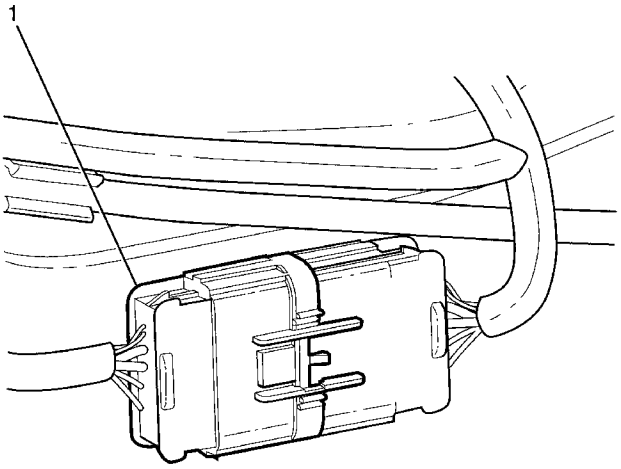
10. Install the NEW rear frame to chassis retaining bolts (1).

    Do not fully tighten at this stage.

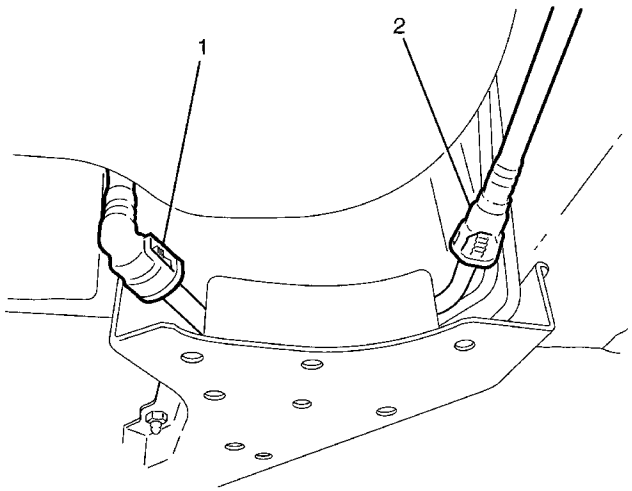
11. Tighten the NEW rear frame to chassis retaining bolts (1) and (2) to:

    First Pass
    Tighten the bolts to 65 N·m (48 lb ft).

    Final Pass
    Tighten the bolts a further 125 degrees.

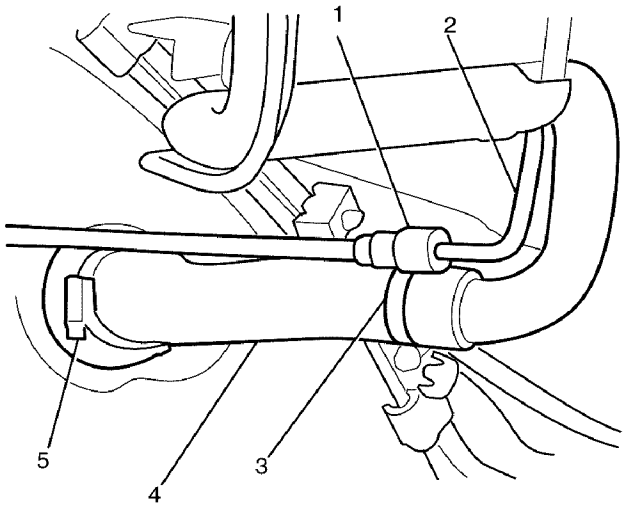


12. Connect the fuel tank assembly electrical connector (1) to the chassis electrical harness.



Note: Listen for an audible click to confirm correct installation.

13. Connect the EVAP line (2) to the EVAP chassis pipe. Refer to Plastic Collar Quick Connect Fitting Service.
14. Connect the fuel feed line (1) to the chassis fuel feed pipe.

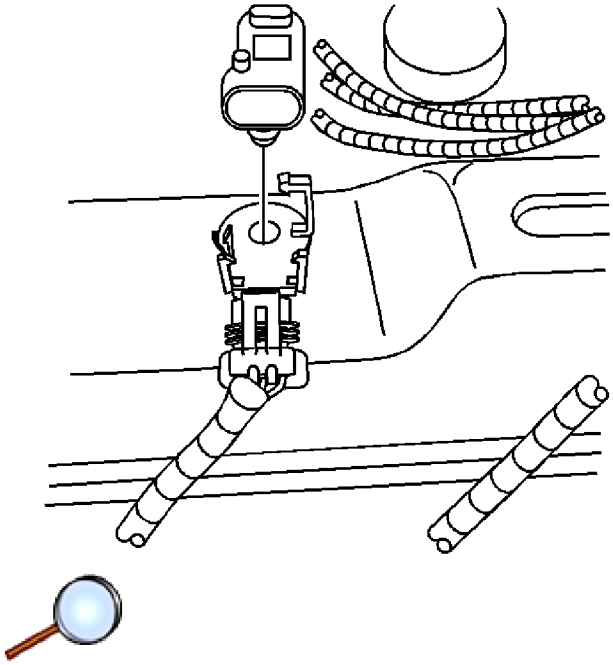


15. Install the fuel filler hose (4) to the vehicle.
16. Install the retaining hose clamp (3) to the fuel filler hose (4) and tighten to **4 N·m (35 lb in).**
17. Install the retaining hose clamp (5) to the fuel filler hose (4) and tighten to **4 N·m (35 lb in).**
18. Connect the lower EVAP line (1) to the upper EVAP line (2). Refer to Plastic Collar Quick Connect Fitting Service.
19. Install the park brake cables. Refer to Parking Brake Rear Cable Replacement.
20. Install the propeller shaft. Refer to Propeller Shaft Replacement.
21. Install the exhaust system. Refer to Exhaust System Replacement.
22. Install the right rear wheel. Refer to Tire and Wheel Removal and Installation.
23. Lower the vehicle to the ground.
24. Fill the fuel tank with the drained fuel.
25. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.
26. Inspect for fuel leaks using the following procedure:
    - Turn ON the ignition, with the engine OFF for 2 seconds.
    - Turn OFF the ignition, for 10 seconds.
    - Turn ON the ignition, with the engine OFF.
    - Inspect for leaks.

Fuel Tank Pressure Sensor Replacement

Removal Procedure

1. Remove the fuel tank. Refer to Fuel Tank Replacement .



2. Disconnect the electrical connector from the fuel tank pressure sensor.
3. Open the retaining strap.
4. Carefully pry the locking tabs away from the pressure sensor.
5. Pull upward in order to remove the pressure sensor from the fuel tank.

Installation Procedure

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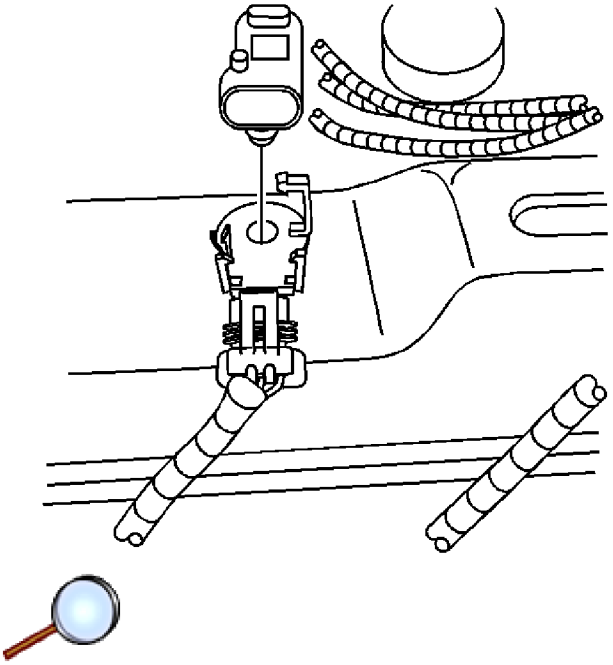


1. Press the fuel tank pressure sensor into the fuel tank, until the locking tabs are fully seated.
2. Close the retaining strap.
3. Connect the electrical connector to the fuel tank pressure sensor.
4. Install the fuel tank. Refer to Fuel Tank Replacement .

Filler Tube Replacement

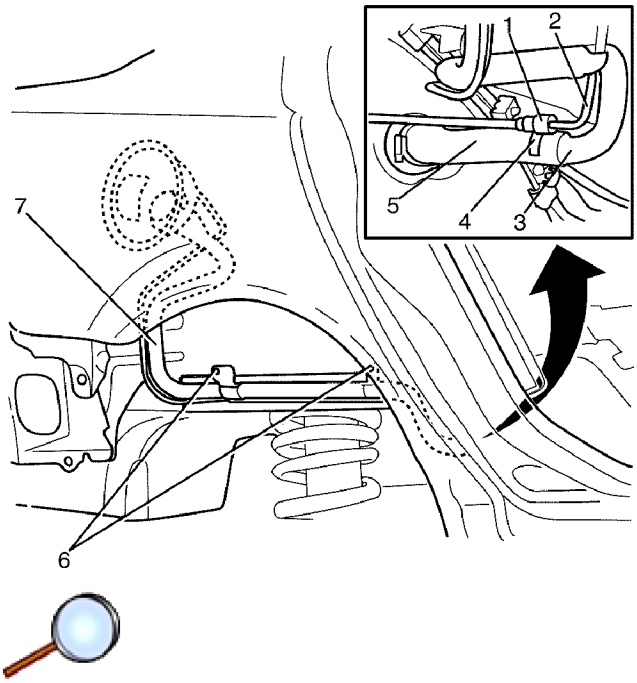
Removal Procedure

1. Remove the fuel filler cap.

   Warning: Refer to Safety Glasses Warning in the Preface section.

   Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
3. Drain the fuel tank below the level of the fuel filler hose. Refer to Fuel Tank Draining.
4. Remove the right rear wheel. Refer to Tire and Wheel Removal and Installation.
5. Remove the right rear wheelhouse Liner. Refer to Rear Inner Wheelhouse Replacement.
6. Remove the rear bumper fascia. Refer to Rear Bumper Fascia Replacement.



7. Remove the filler tube to chassis retaining bolts (6).
8. Disconnect the evaporative emission (EVAP) line (2) from the quick connect fitting (1). Refer to Plastic Collar Quick Connect Fitting Service.
9. Remove the retaining hose clamp (4).
10. Disconnect the fuel filler tube (3) from the fuel filler hose (5).
11. Manoeuvre the fuel filler tube (7) and remove from the vehicle.

Installation Procedure

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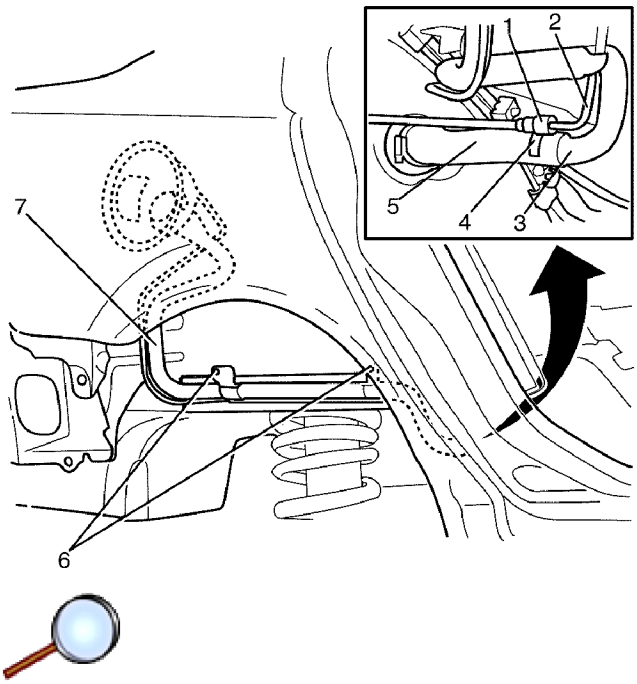


1. Install the fuel filler tube (7) to the vehicle.
2. Connect the fuel filler tube (3) to the fuel filler hose (5).

Notice: Refer to Fastener Caution in the Preface section.

3. Install the retaining hose clamp (4) and tighten the fuel filler tube hose clamp (3) to 3.5 N·m (31 lb in).

Note: Listen for and audible click to confirm correct installation.

4. Connect the evaporative emission (EVAP) line (2) to the quick connect fitting (1).
5. Install the filler tube to chassis retaining bolts (6) and tighten to 9 N·m (80 lb in).
6. Install the rear bumper fascia. Refer to Rear Bumper Fascia Replacement.
7. Install the right rear wheelhouse Liner. Refer to Rear Inner Wheelhouse Replacement.
8. Install the right rear wheel. Refer to Tire and Wheel Removal and Installation.

Primary Fuel Tank Module Replacement

Special Tools

J 45747 Fuel Tank Sender Wrench

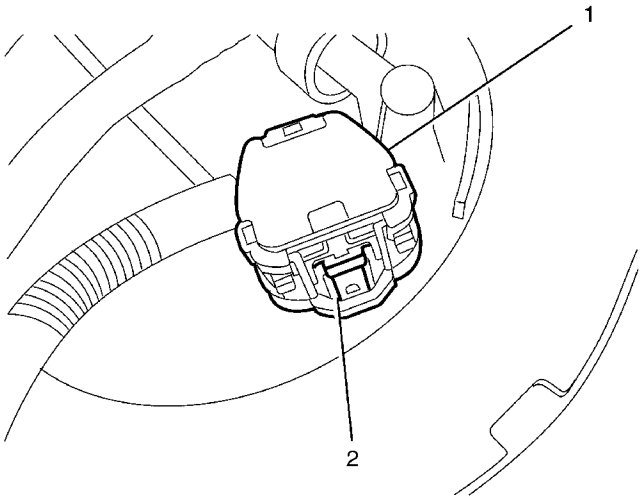
Removal Procedure

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

Warning: Refer to Safety Glasses Warning in the Preface section.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Remove the fuel tank. Refer to Fuel Tank Replacement.



Note: Press release tab (2) on the electrical connector to release.

2. Disconnect the electrical connector (1) from the primary fuel tank module.

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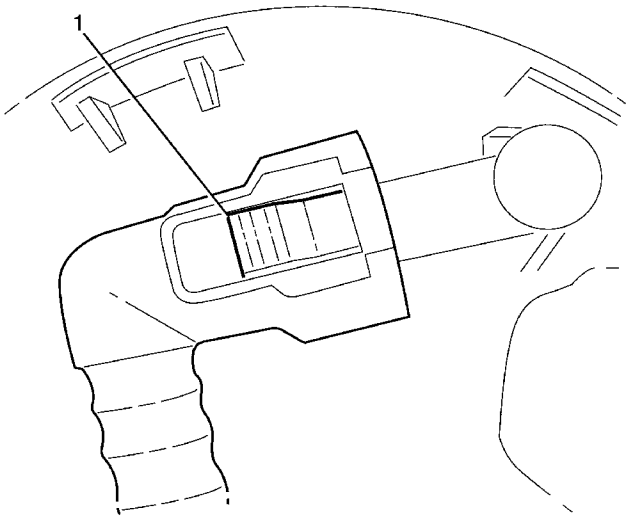
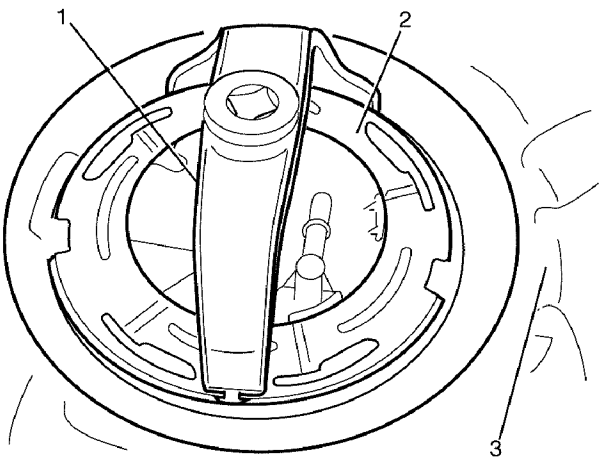


3. Remove the fuel supply tube. Refer to Plastic Collar Quick Connect Fitting Service.

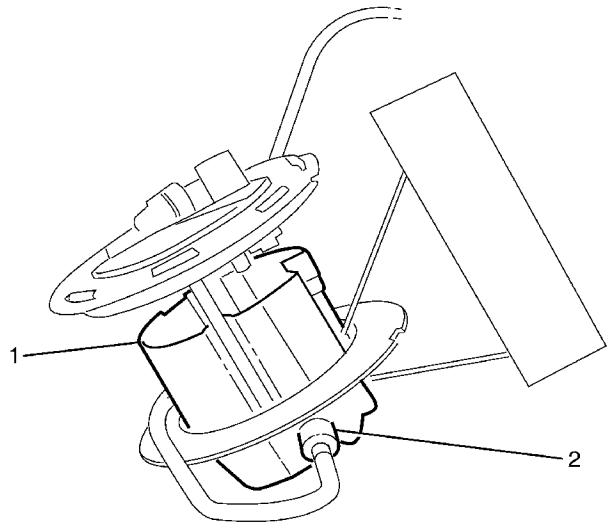


Note: Do not allow the tool to come in contact with the fuel pipes while unlocking the cam lock ring.

4. Rotate the cam lock ring (1) counter-clockwise using the J 45747 .

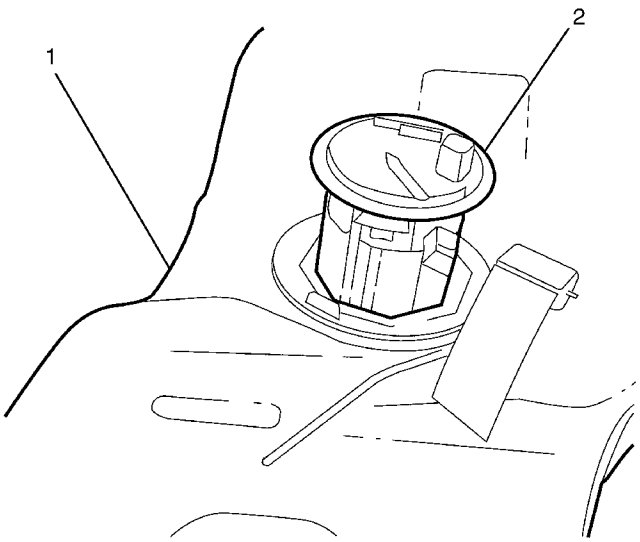
Note: The cam lock ring (1) is a single use part and therefore must be discarded after removal.

5. Remove the cam lock ring (1) from the fuel tank.

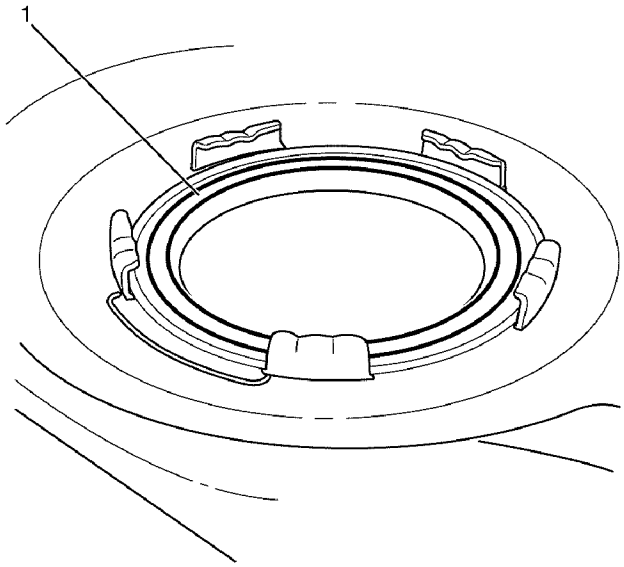


Note: The primary fuel tank module (1) is vertical in the installed position, but pivots for removal.

6. Carefully lift the primary fuel tank module (1) from the fuel tank only enough to access the transfer tube (2).
7. Disconnect the fuel transfer tube from the module assembly (2).



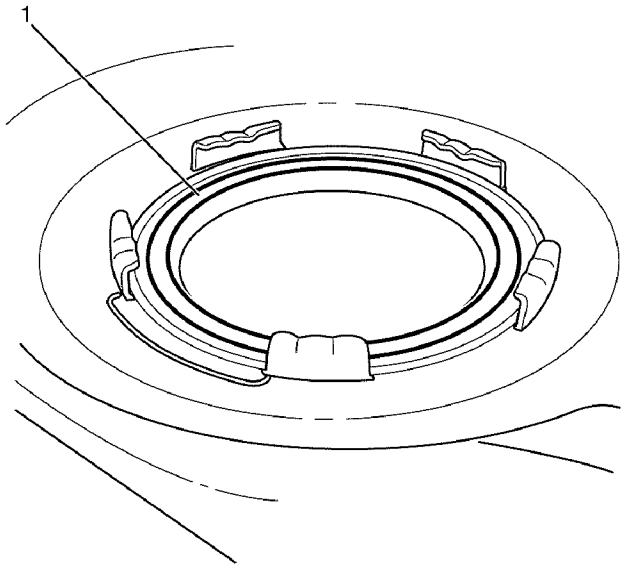
8. Remove the primary fuel tank module (1) from the fuel tank (2).



9. Remove the primary fuel tank module seal (1) from the primary fuel tank module.

   Discard the primary fuel tank module seal.

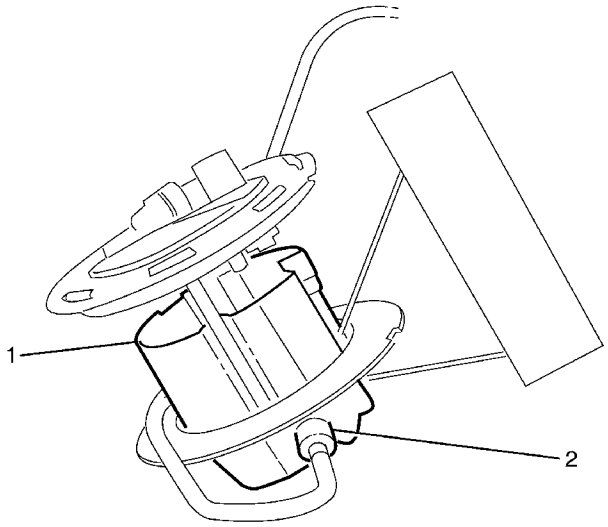
Installation Procedure



Note: Make sure the seal bead is facing the fuel tank.

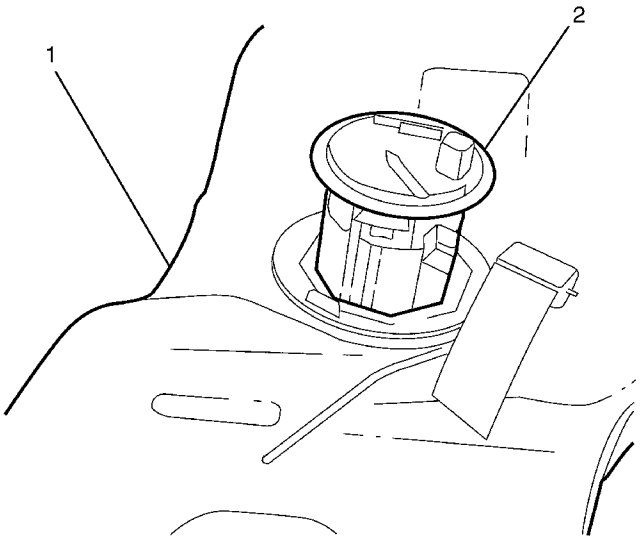
Note: Lubricate the seal before installation with an approved lubricant.

1. Place a NEW primary fuel tank module seal (1) over the primary fuel tank module (2).

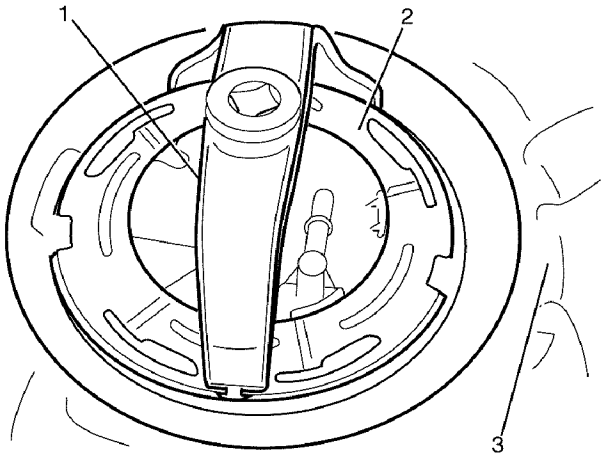


Note: The primary fuel tank module (1) is vertical in the installed position, but pivots for installation/removal.

2. Carefully install the primary fuel tank module (1) to the fuel tank only enough to access the transfer tube (2).
3. Connect the fuel transfer tube to the primary fuel tank module assembly (2).



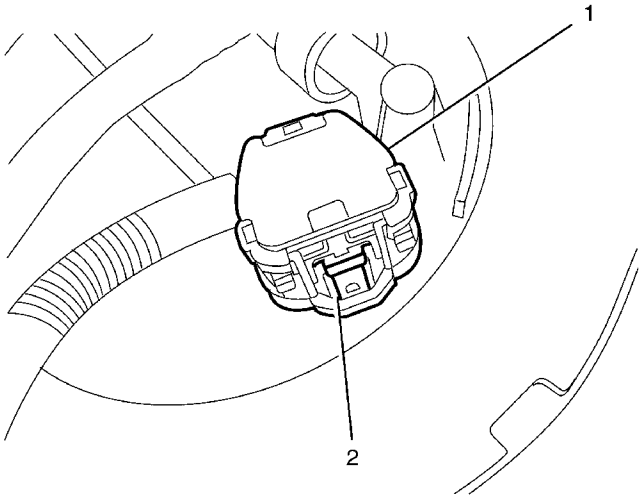
4. Install the primary fuel tank module (1) to the fuel tank (2).



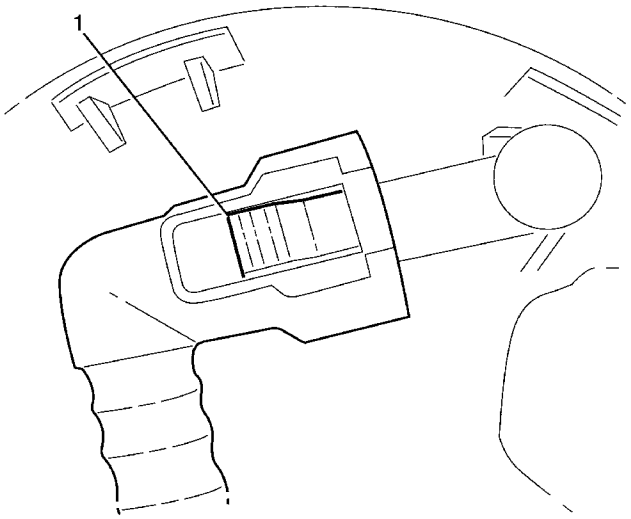
5. Install a NEW cam lock ring (1) to the fuel tank.

Note: Do not allow the tool to come in contact with the fuel pipes while locking the cam lock ring.

6. Rotate the cam lock ring (1) clockwise using the J 45747 until fully seated.



7. Connect the electrical connector (1) to the primary fuel tank module.



8. Install the fuel supply tube to the fuel tank module. Refer to Plastic Collar Quick Connect Fitting Service.
9. Install the fuel tank. Refer to Fuel Tank Replacement.

Secondary Fuel Tank Module Replacement

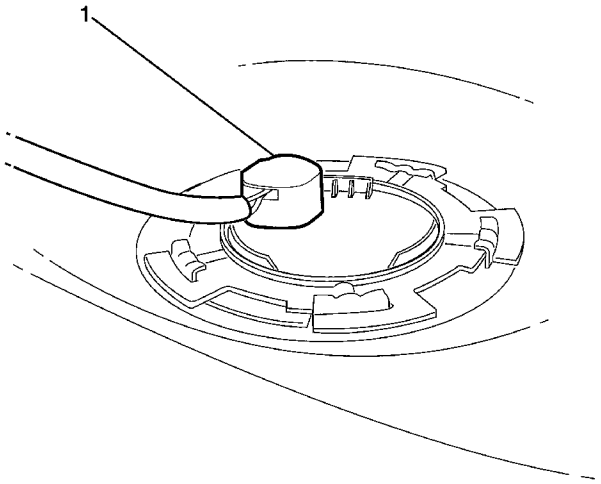
Special Tools

- EN-48278 Fuel Tank Sender Wrench
- CH-48482 Fuel Tank Sender Wrench

Removal Procedure

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

1. Remove the fuel tank. Refer to Fuel Tank Replacement.



2. Disconnect the secondary fuel tank module electrical connector (1).

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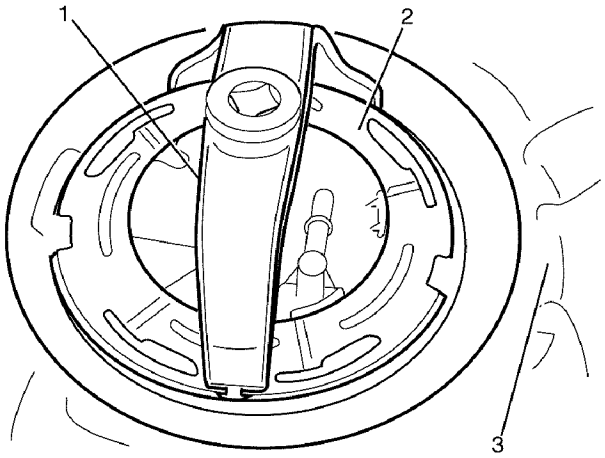
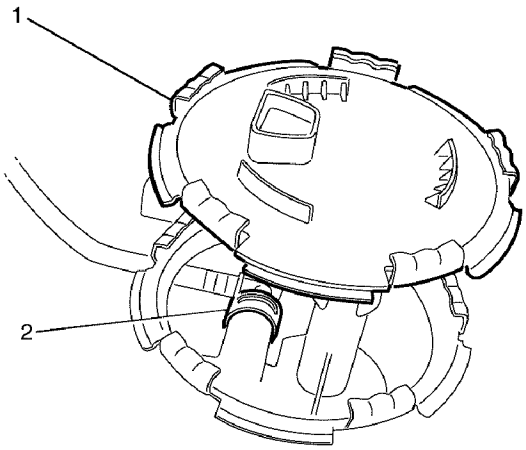


3. Rotate the cam lock ring (1) counterclockwise using the EN-48278 .

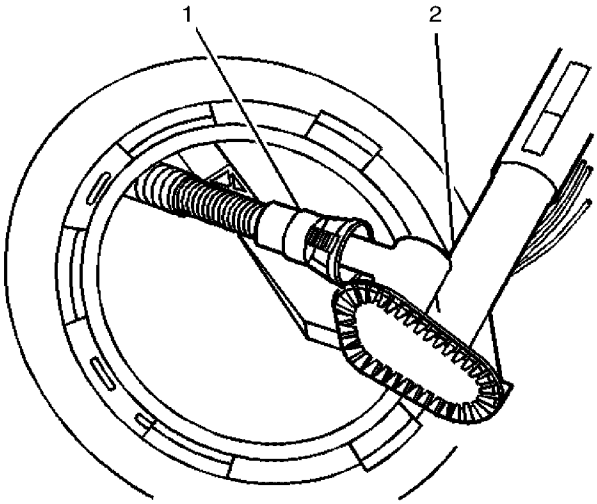
Note: The cam lock ring (1) is a single use part and therefore must be discarded after removal.

4. Remove the cam lock ring (1) from the fuel tank.

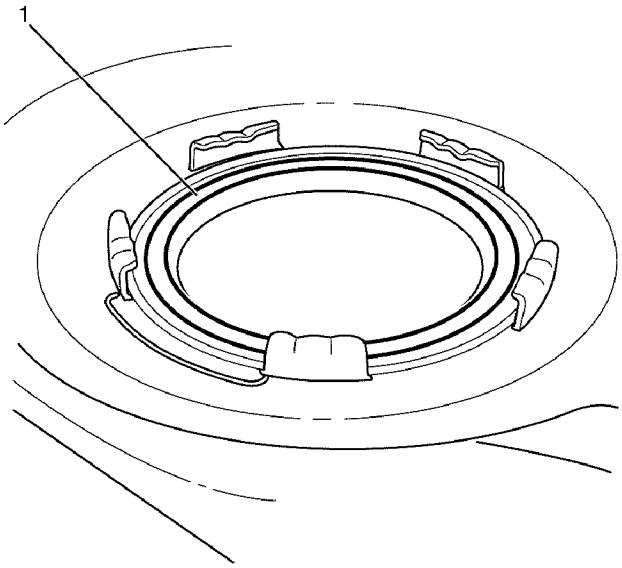


Note: The secondary fuel tank module (1) is vertical in the installed position, but pivots for removal.

5. Carefully lift the secondary fuel tank module (1) from the fuel tank only enough to access the transfer tube (2).



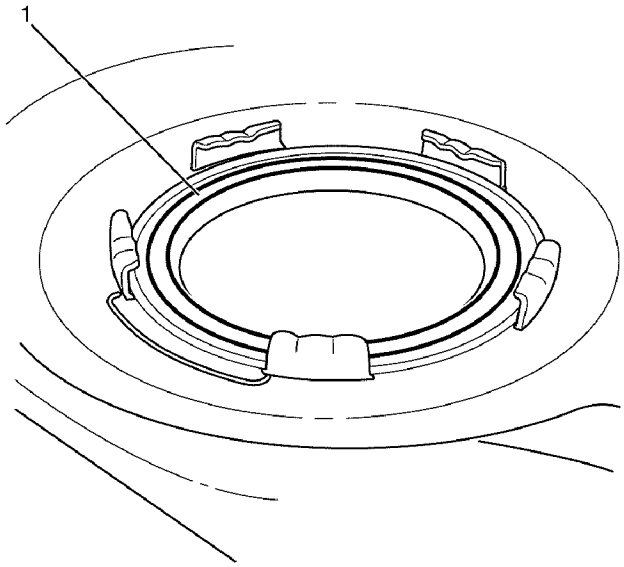
6. Remove the fuel supply tube (1). Refer to Plastic Collar Quick Connect Fitting Service.
7. Remove the secondary fuel tank module (2) from the fuel tank.



8. Remove the secondary fuel tank module seal (1) from the secondary fuel tank module (2).

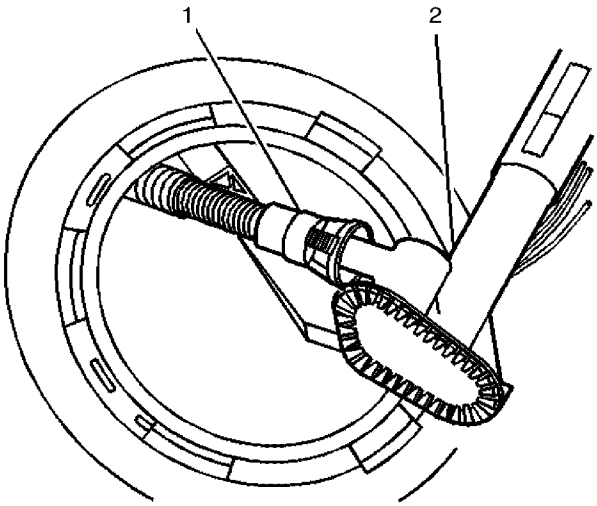
   Do not reuse the seal.

Installation Procedure



Note: Make sure the seal bead is facing the fuel tank.

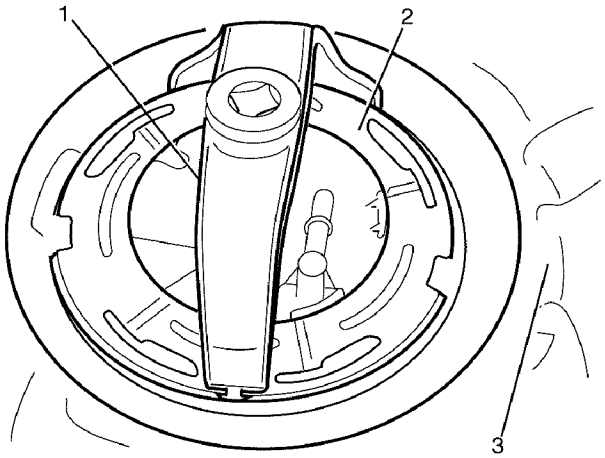
1. Place the NEW secondary fuel tank module seal (1) over the secondary fuel tank module (2).



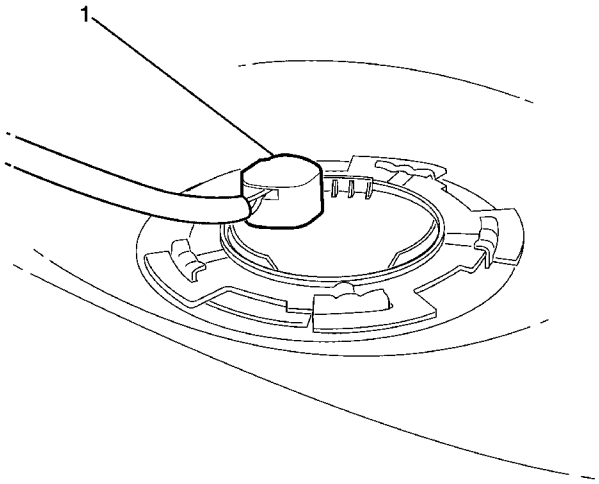
2. Complete the following in order to connect the transfer tube (1) to the secondary fuel tank module (2):
   2.1. Grasp the transfer tube (1) from inside the fuel tank.
   2.2. Position the module (2) near the module opening.
   2.3. Connect the transfer tube (1) to the module (2).

Note: Make sure the fuel level float is free from binding while inserting the module (2).

3. Carefully insert the secondary fuel tank module (2) into the fuel tank.
4. Press the secondary fuel tank module (2) downward, aligning the module to the encapsulated ring.
5. Position the cam lock ring to the fuel tank.



6. Install a NEW cam lock ring (2) to the fuel tank (3).
7. Rotate the cam lock ring (2) clockwise using the CH-48482 until fully seated.



8. Connect the secondary fuel tank module electrical connector (1).
9. Install the fuel tank. Refer to Fuel Tank Replacement.

Fuel Level Sensor Replacement

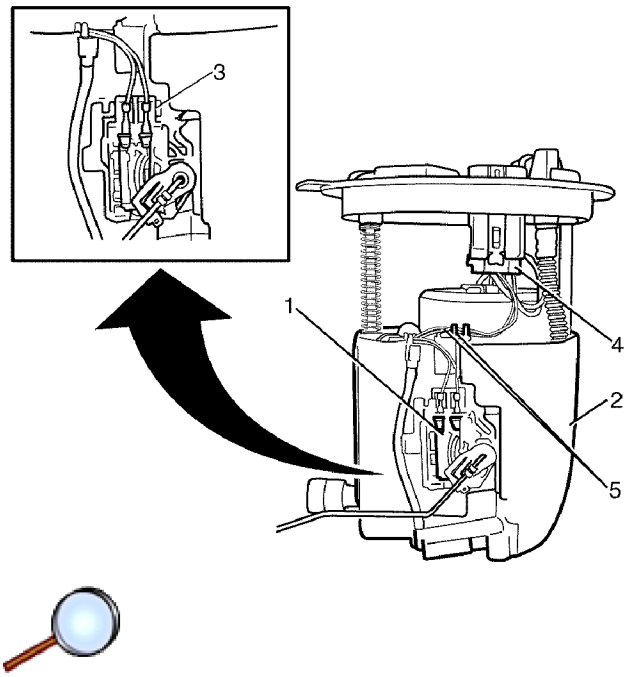
Removal Procedure

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

Warning: Refer to Safety Glasses Warning in the Preface section.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Remove the fuel tank. Refer to Fuel Tank Replacement.
2. Remove the primary fuel tank module assembly from the fuel tank. Refer to Primary Fuel Tank Module Replacement.



3. Disconnect the fuel level sensor connector (4) and unclip the wiring from the harness securing clips (5).
4. Remove the fuel level sensor from the primary fuel tank module assembly.
5. Unlock the locking clip (3) and gently push the fuel level sensor upwards.
6. Remove the fuel level sensor from the primary fuel tank module assembly.

Installation

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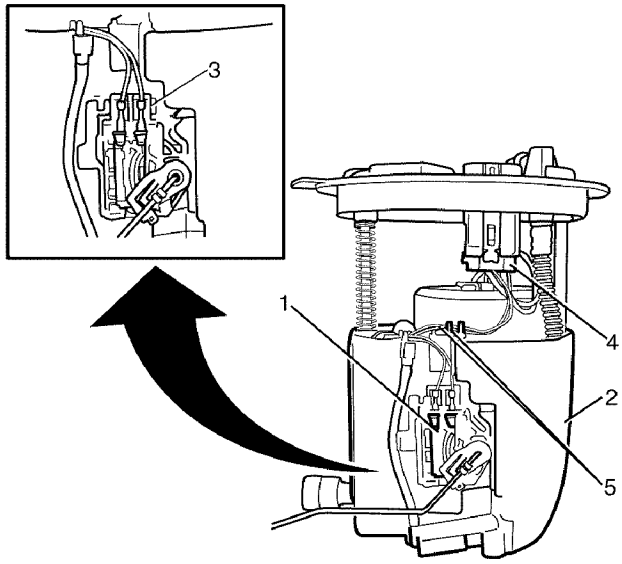


1. Locate and install the fuel tank level sensor (1) to the primary fuel tank module assembly (2). Make sure that the locking clip (3) engages.
2. Connect the fuel level sensor connector (4) and route the wiring through the harness securing clips (5).
3. Install the fuel level sensor to the primary fuel tank module assembly.
4. Install the primary fuel tank module assembly to the fuel tank. Refer to Primary Fuel Tank Module Replacement.
5. Install the fuel tank. Refer to Fuel Tank Replacement.

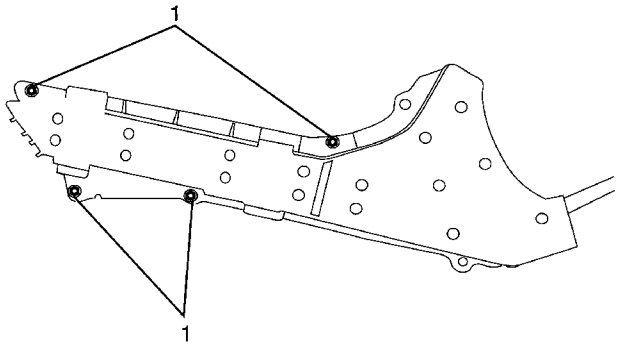
Fuel Hose/Pipes Replacement - Chassis

Removal Procedure

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

Note: The fuel system hose/pipes are serviceable individually or as a complete fuel/brake bundle assembly. The following procedure is servicing the fuel hose/pipes individually.

1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
2. Before you service any fuel system connection, relieve the fuel system pressure. Refer to the Fuel Pressure Relief.
3. Remove the exhaust and exhaust heat shields. Refer to Exhaust System Replacement.
4. Remove the engine. Refer to Engine Replacement.
5. Disconnect the fuel and evaporative emission (EVAP) lines at the fuel tank. Refer to Fuel Tank Replacement.
6. Disconnect the fuel and EVAP lines at the engine compartment.



7. Remove the retaining bolts (1) and the retaining nuts (1) securing the rear stone guard.

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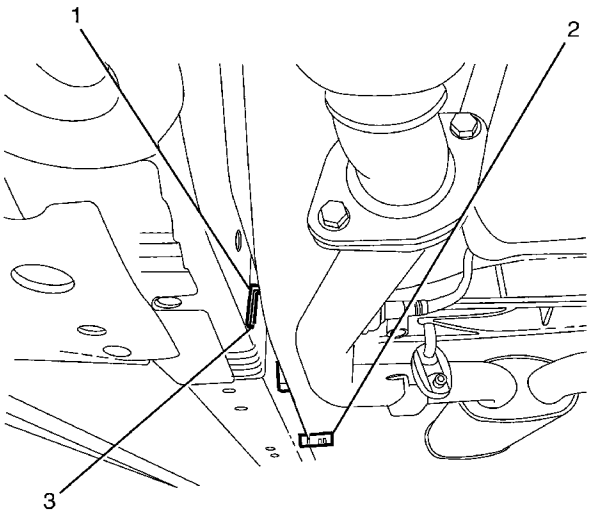
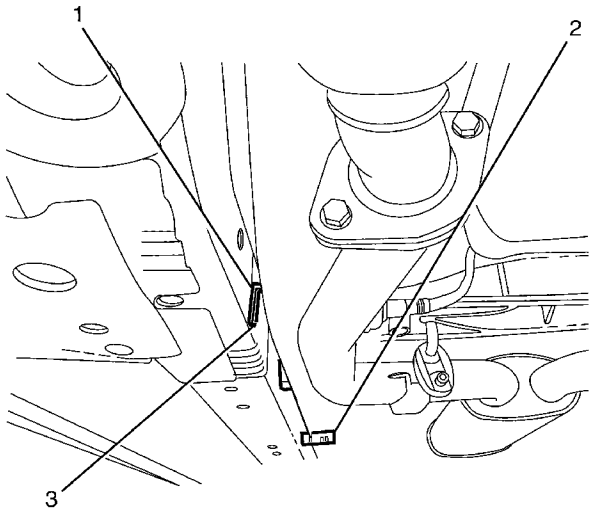
8. Remove all the fuel line bracket pop rivets securing the fuel and EVAP pipes to the vehicle body.



9. Remove all the fuel line bracket pop rivets (1, 2, 3) securing the fuel and EVAP pipes to the body tunnel.
10. Remove the fuel and EVAP lines from the vehicle.

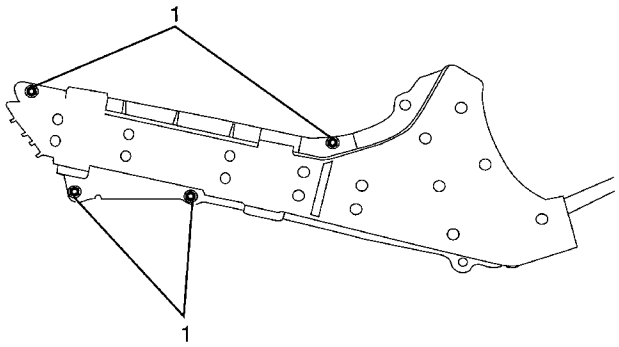
Installation Procedure

1. Install the fuel and EVAP lines to the vehicle.



2. Install all the fuel line bracket pop rivets (1, 2, 3) securing the fuel and EVAP pipes to the body tunnel.

3. Install all the fuel line bracket pop rivets securing the fuel and EVAP pipes to the vehicle body.



4. Install the retaining bolts (1) and the retaining nuts (1) securing the rear stone guard.
5. Connect the fuel and EVAP lines at the engine compartment.
6. Connect the fuel and EVAP lines at the fuel tank. Refer to Fuel Tank Replacement.
7. Install the engine. Refer to Engine Replacement.
8. Install the exhaust and exhaust heat shields. Refer to Exhaust System Replacement.
9. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

Fuel System Cleaning

Special Tools

- J 45722 Fuel Sender Lock Ring Wrench
- CH-48482 Fuel Sender Lock Ring Wrench
- J 45004 Fuel Tank Drain Hose

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

Note:
- The following procedure covers the disassembly and the inspection of the complete fuel supply system. If the fuel system is contaminated, the fuel system can be cleaned. You can usually determine the extent of the fuel system contamination during the disassembly.
- If the fuel filter is plugged, the fuel tank should be inspected internally and cleaned if necessary.

1. Remove the fuel tank. Refer to Fuel Tank Replacement.
2. Remove the fuel module assemblies. Refer to Primary Fuel Tank Module Replacement and Secondary Fuel Tank Module Replacement.
3. Locate the tank in a suitable work area away from any heat, any flame, or any other source of ignition.
4. Perform the following procedures:
   - Inspect the fuel sender strainer. Replace the primary fuel tank module if the strainer is contaminated.
   - Inspect the secondary fuel tank module for debris. Clean the secondary fuel tank module if debris is found.

     Warning: Wear safety glasses when using compressed air, as flying dirt particles may cause eye injury.

     Note: Only use oil-free compressed air to blow out the fuel pipes.

   - Use compressed air in order to apply air pressure to the transfer tube.

   Note: When flushing the fuel tank, handle the fuel and water mixture as a hazardous material. Handle the fuel and water in accordance with all applicable local, state, and federal laws and regulations.

5. Flush the fuel tank with running hot water for at least five minutes. Pour the water out of the fuel sender assembly opening. Rock the tank in order to make sure that the removal of the water from the tank is complete.
6. Refer to Metal Collar Quick Connect Fitting Service to disconnect the following quick connect fittings from the fuel rail:

   The feed hose/pipe

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Note: Only use oil-free compressed air to blow out the fuel pipes.

7. Use compressed air in order to apply air pressure to the fuel lines in the opposite direction from the normal fuel flow.
8. Remove the fuel injectors and fuel rail. Refer to Fuel Injector and Fuel Rail Replacement.
9. Clean and inspect the fuel injectors and fuel rail.

Installation Procedure

1. Assemble the fuel system as follows:

   Install the fuel injectors and fuel rail. Refer to Fuel Injector and Fuel Rail Replacement.

2. Install the fuel module assemblies. Refer to Primary Fuel Tank Module Replacement and Secondary Fuel Tank Module Replacement.
3. Refer to Metal Collar Quick Connect Fitting Service to connect the following quick connect fittings to the fuel rail:

   The feed hose/pipe

4. Install the fuel tank. Refer to Fuel Tank Replacement.

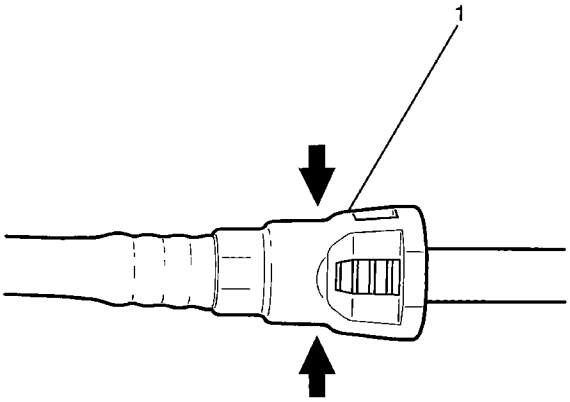
Fuel Injector and Fuel Rail Replacement

Removal Procedure

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

Warning: Refer to Safety Glasses Warning in the Preface section.

1. Relieve the fuel system pressure. Refer to Fuel Pressure Relief.
2. Remove the upper intake manifold with the lower intake manifold. Refer to Upper Intake Manifold Replacement.



3. Remove the fuel pipe retaining clip (1).

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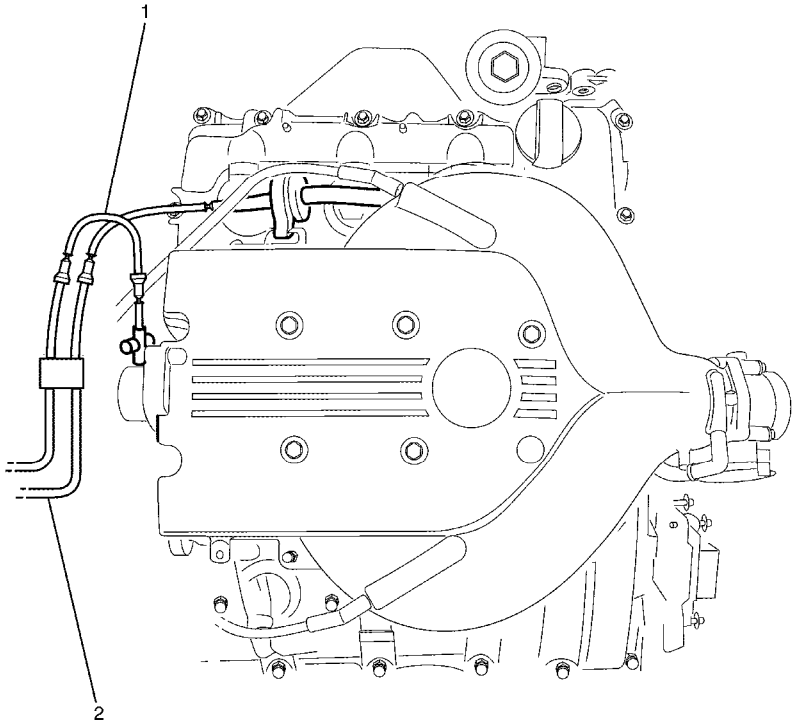
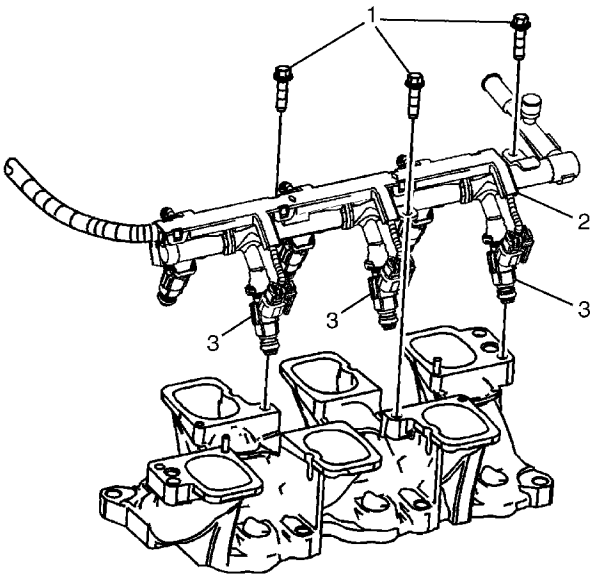


4. Disconnect the fuel feed line pipe (2) from the fuel injector rail. Refer to Metal Collar Quick Connect Fitting Service.

Warning: Refer to Safety Glasses and Compressed Air Warning in the Preface section.

5. Use compressed air in order to remove debris from the area where the fuel injectors enter the intake manifold.

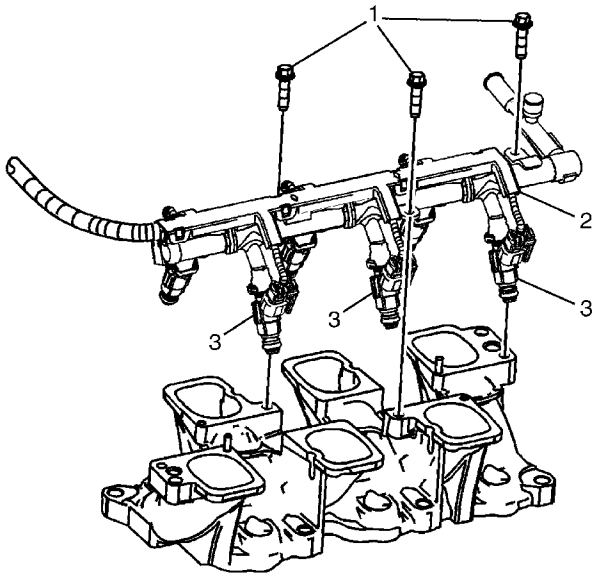


6. Remove the fuel rail to lower inlet manifold retaining bolts (1).

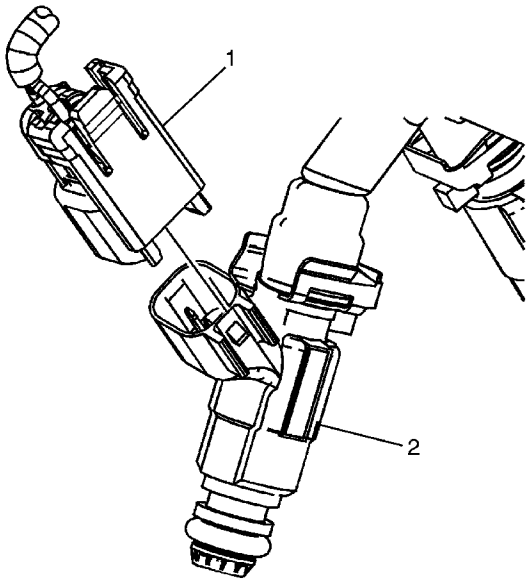
Caution:

- Remove the fuel rail assembly carefully in order to prevent damage to the injector electrical connector terminals and the injector spray tips. Support the fuel rail after the fuel rail is removed in order to avoid damaging the fuel rail components.
- Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering open pipes and passages.

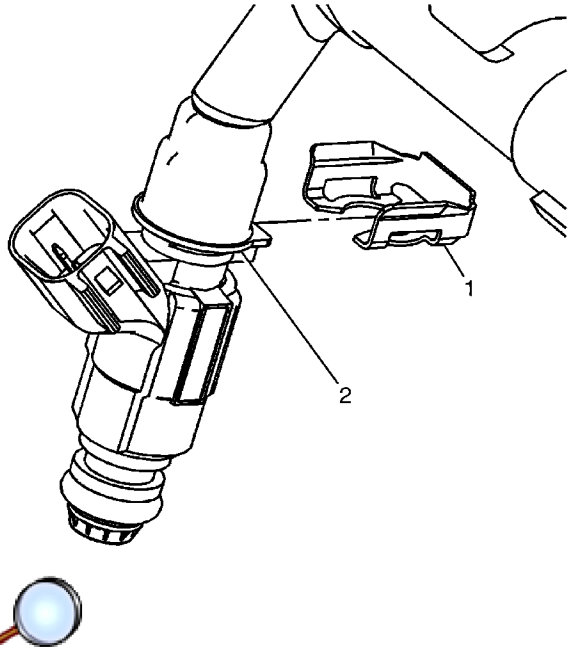
7. Remove the fuel rail (2) and the fuel injectors (3) from the manifold.



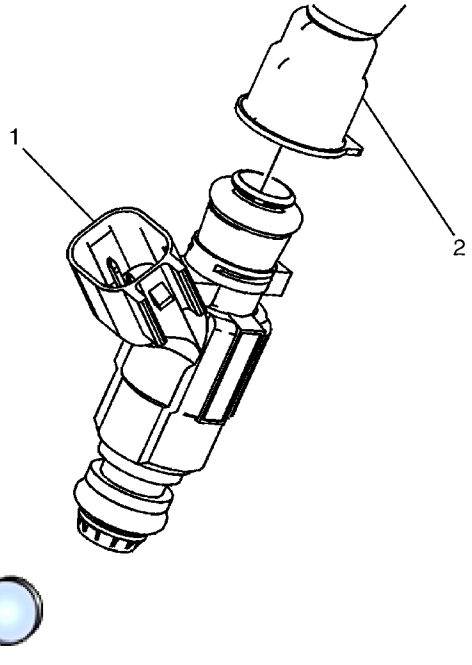
8. Disengage the fuel injector electrical connector lock (1).



9. Disconnect the fuel injector electrical connector (1) from the fuel injector (2).



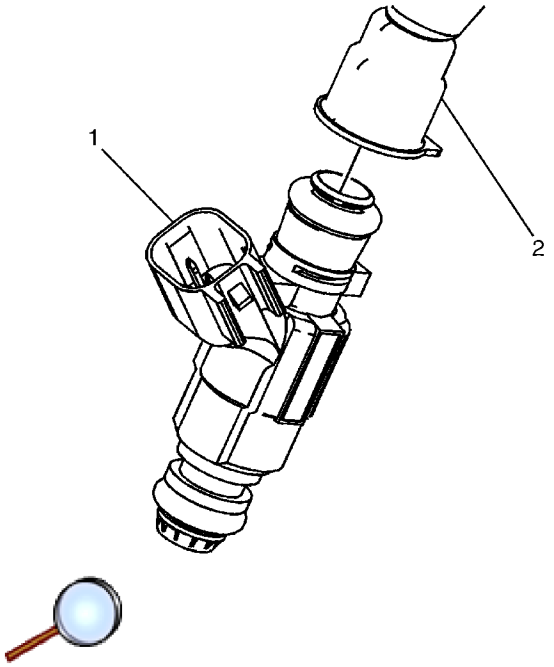
10. Remove the fuel injector retainer clip (1) from the fuel rail (2).



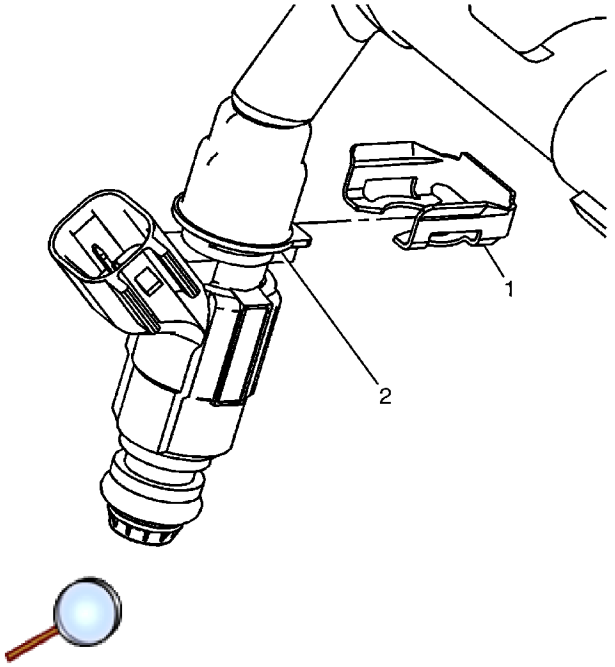
11. Remove the fuel injector (1) from the fuel rail (2).
12. Remove and discard the fuel injector seals.

Installation Procedure

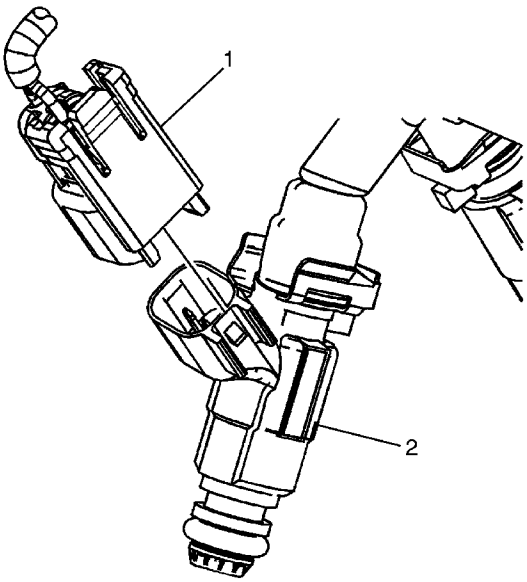
1. Install NEW fuel injector seals.



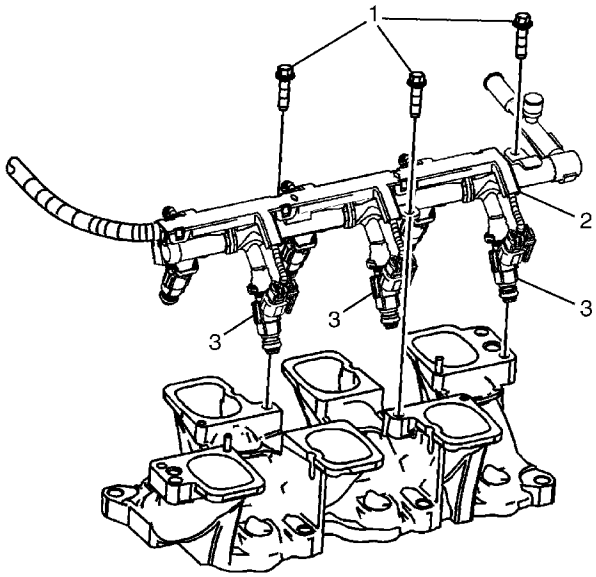
2. Install the fuel injector (1) to the fuel rail (2).



3. Install the fuel injector retainer clip (1) to the fuel rail (2).



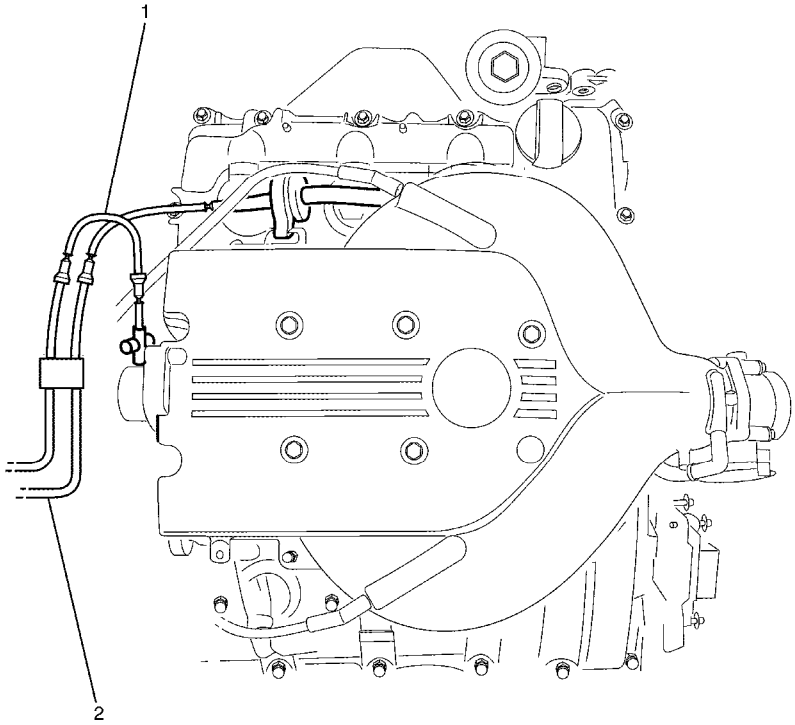
4. Install the fuel injector electrical connector (1) to the fuel injector (2).
5. Engage the fuel injector electrical connector lock.



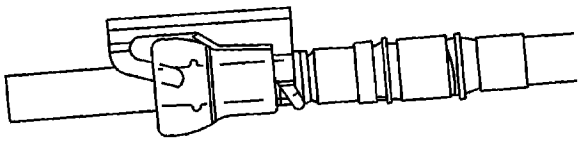
6. Install the fuel rail (2) with the fuel injectors (1) to the lower manifold.

   Caution: Refer to Fastener Caution in the Preface section.

7. Install the fuel rail to lower manifold retaining bolts (1) and tighten to **10 N·m (89 lb in)**.



8. Connect the fuel feed line (1) to the fuel rail. Refer to Metal Collar Quick Connect Fitting Service.

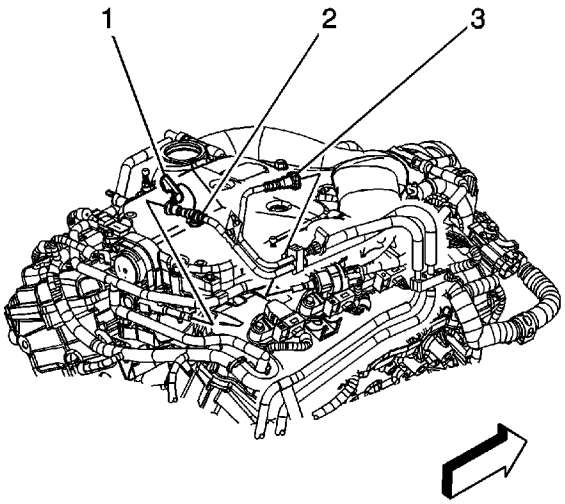


9. Install the fuel pipe retaining clip.
10. Install the upper intake manifold. Refer to Upper Intake Manifold Replacement.

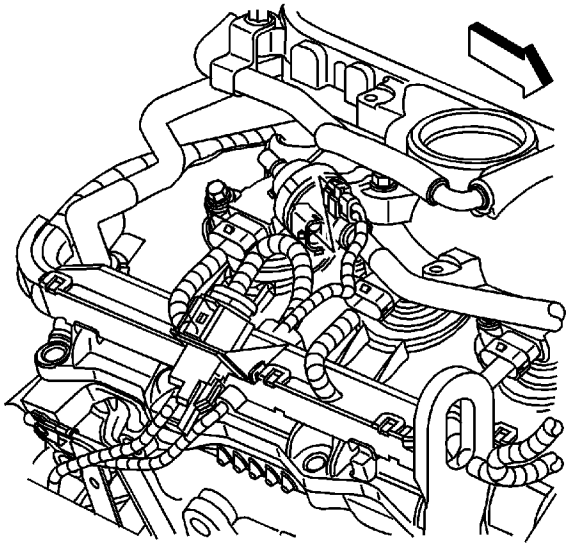
Evaporative Emission Canister Purge Solenoid Valve Replacement

Removal Procedure

1. Turn the ignition OFF.



2. Disconnect the purge line (3) from the purge valve solenoid.



3. Disconnect the purge valve solenoid electrical connector.

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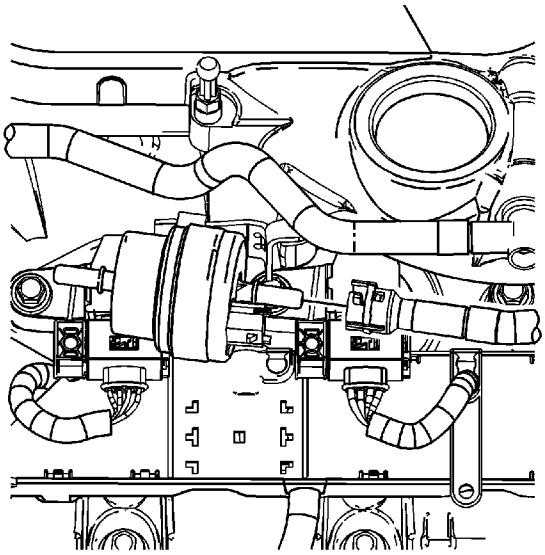
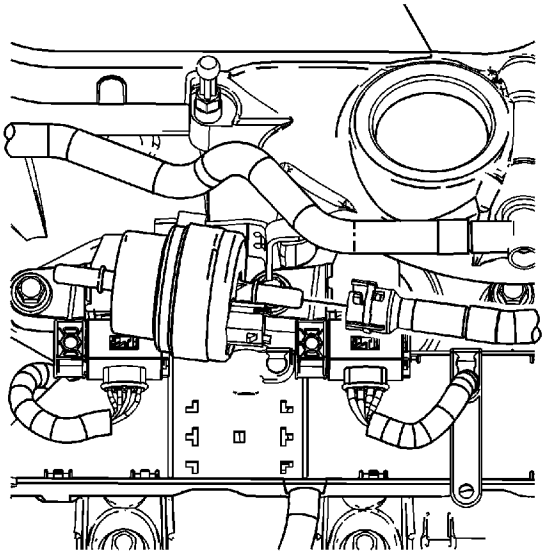
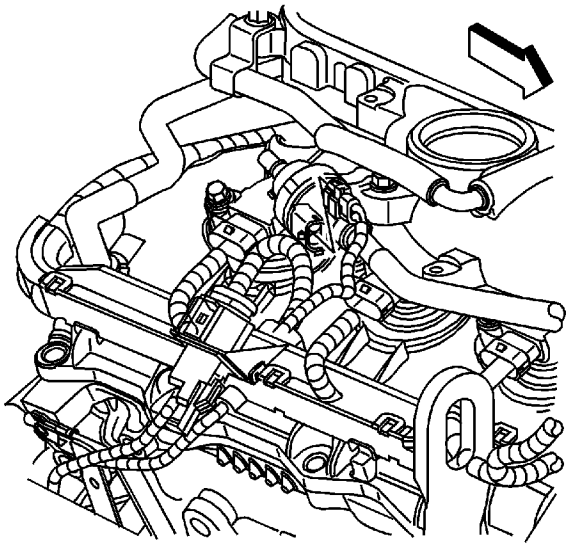


4. Disconnect the purge line from the manifold side of the purge valve solenoid.
5. Remove the purge valve solenoid from the bracket.

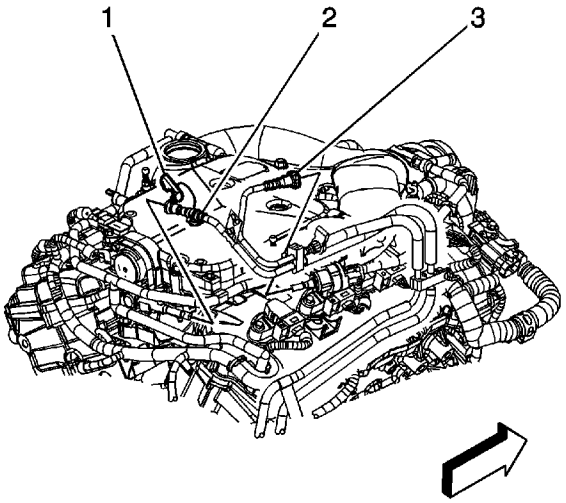
Installation Procedure



1. Install the purge valve solenoid to the bracket.
2. Disconnect the purge line from the manifold side of the purge valve solenoid.



3. Disconnect the purge valve solenoid electrical connector.

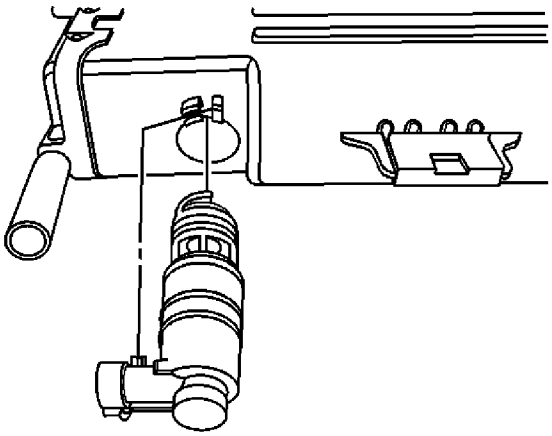


4. Connect the purge line (3) to the purge valve solenoid.

Evaporative Emission Canister Vent Solenoid Valve Replacement

Removal Procedure

1. Remove the evaporative emission (EVAP) canister. Refer to Evaporative Emission Canister Replacement .
2. Clean away any debris that may be present around the EVAP canister vent valve.



3. Twist the EVAP canister vent valve counterclockwise.
4. Pull the EVAP canister vent valve from the EVAP canister.

Installation Procedure

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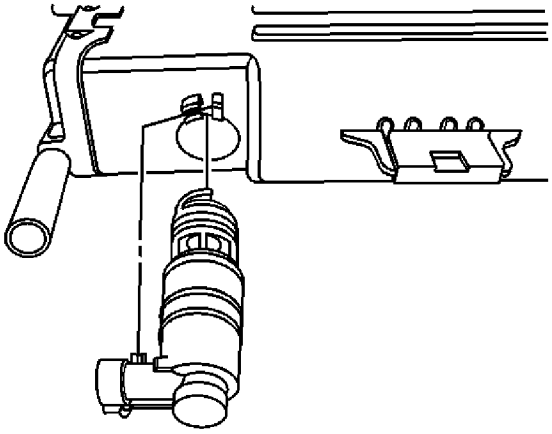


1. Insert the EVAP canister vent valve into the EVAP canister.
2. Twist the EVAP canister vent valve clockwise into the locked position.
3. Install the EVAP canister. Refer to Evaporative Emission Canister Replacement .

Evaporative Emission Hoses/Pipes Replacement - Chassis/Canister

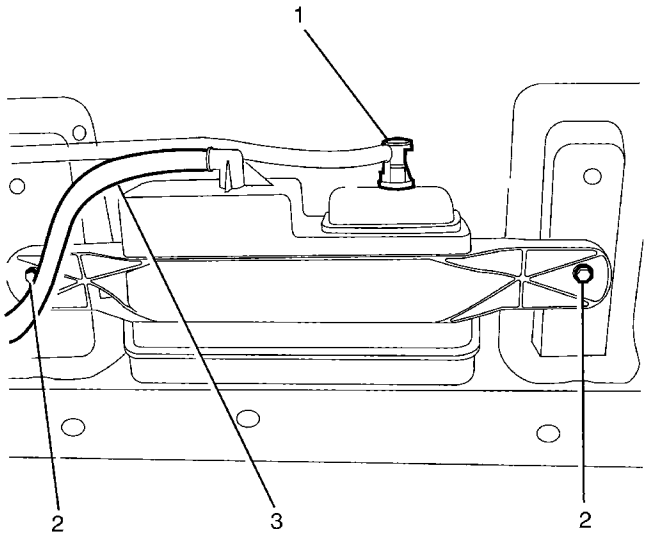
Removal Procedure

- Do not attempt to repair sections of nylon pipes. Replace damaged nylon pipes.
- Replace the vapor hoses/pipes with original equipment or parts that meet original specifications.

Warning: Refer to Safety Glasses Warning in the Preface section.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the rear frame. Refer to Rear Frame Replacement.
3. Remove the fuel tank. Refer to Fuel Tank Replacement.



4. Disconnect the canister purge pipe (1) from the canister.
5. Remove the canister vent pipe (3) from the canister by twisting and pulling it away from the canister.
6. Remove the canister to under body retaining bolts (2).
7. Remove the evaporative emission canister from the vehicle.
8. Remove the EVAP hose from the fuel tank.

Installation Procedure

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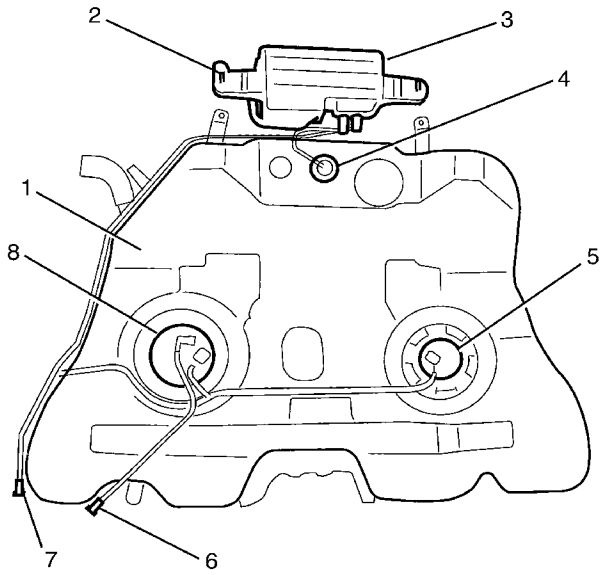


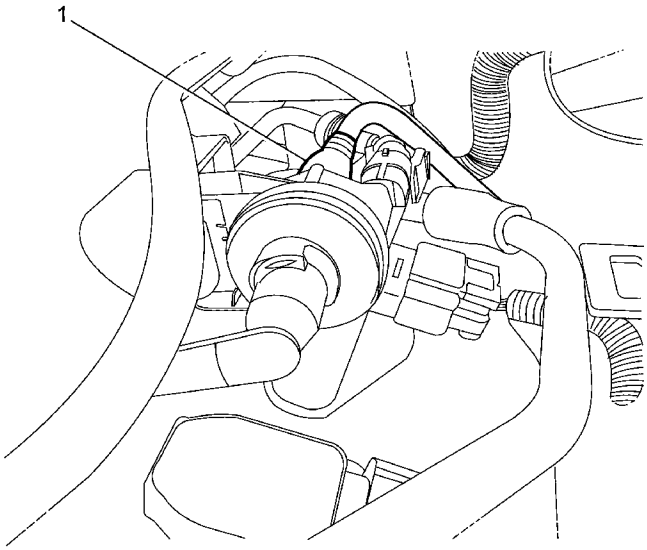
1. Position the EVAP hose to the fuel tank.
2. Install the chassis to canister EVAP hose to the following:
   - The body retainer (1)
   - The 3 retaining features (2) on the fuel tank
   - The retainer clip (3)
3. Install the fuel tank. Refer to Fuel Tank Replacement.
4. Install the rear frame. Refer to Rear Frame Replacement.
5. Lower the vehicle.

Evaporative Emission Canister Purge Pipe Replacement (Up to 03 October 2006)

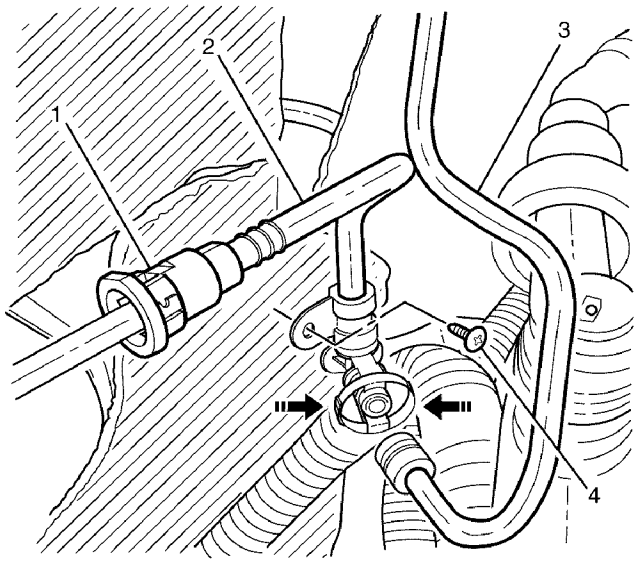
Removal Procedure

1. Remove the upper intake manifold. Refer to Upper Intake Manifold Replacement.

   Warning: Refer to Safety Glasses Warning in the Preface section.



2. Disconnect the emission purge pipe (1). Refer to Plastic Collar Quick Connect Fitting Service.



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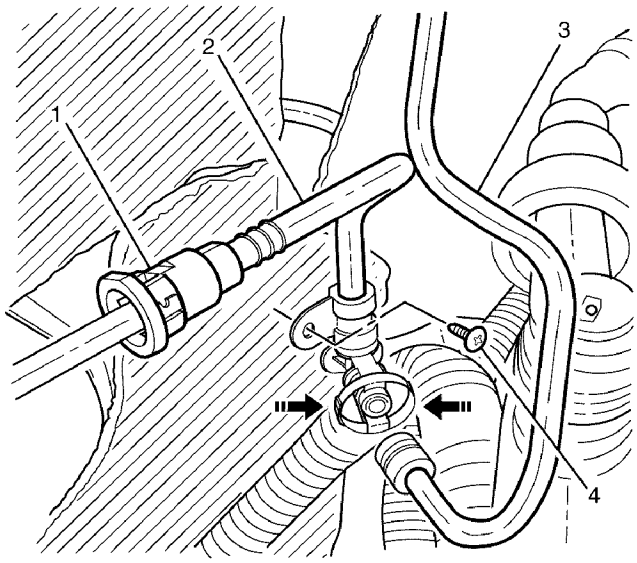
Note: Separate the evaporative emission (EVAP) pipes (2, 3) by squeezing the quick connect fitting and separating the 2 connections.

3. Separate the emission purge pipes (2, 3).
4. Remove the emission purge pipe bracket retaining screw (4).
5. Disconnect the emission purge pipe quick connect fitting (1). Refer to Plastic Collar Quick Connect Fitting Service.
6. Remove the emission purge pipe (2, 3).

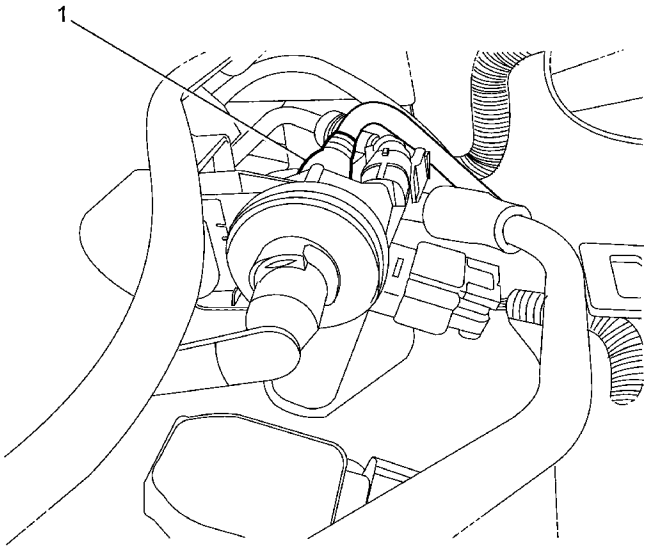
Installation Procedure



1. Connect the emission purge pipe quick connect fitting (1).
2. Install the emission purge pipe bracket retaining screw (4) and tighten to **xx N·m (xx lb in)**.

Note: Push the 2 emission pipes together. Listen for an audible click to confirm fitting.

3. Connect the emission purge pipes (2, 3).



Note: Push the plastic quick connect fitting firmly on to the purge valve solenoid, listen for an audible click to confirm fitting.

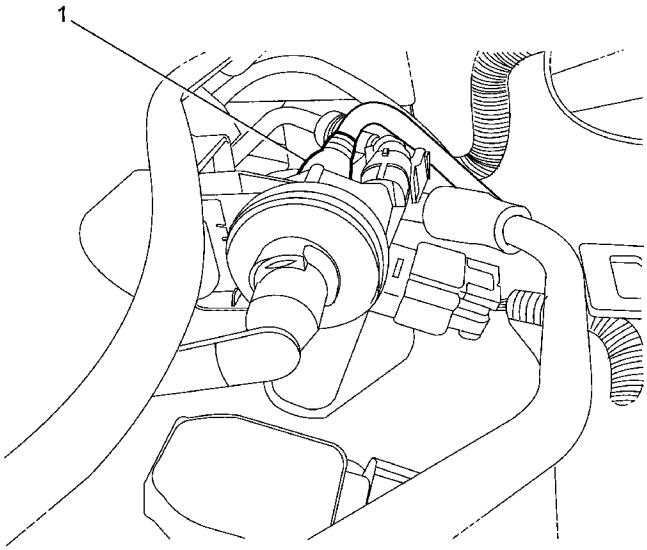
4. Connect the emission purge pipe (1).
5. Install the upper intake manifold. Refer to Upper Intake Manifold Replacement.

Evaporative Emission Canister Purge Pipe Replacement (After 03 October 2006)

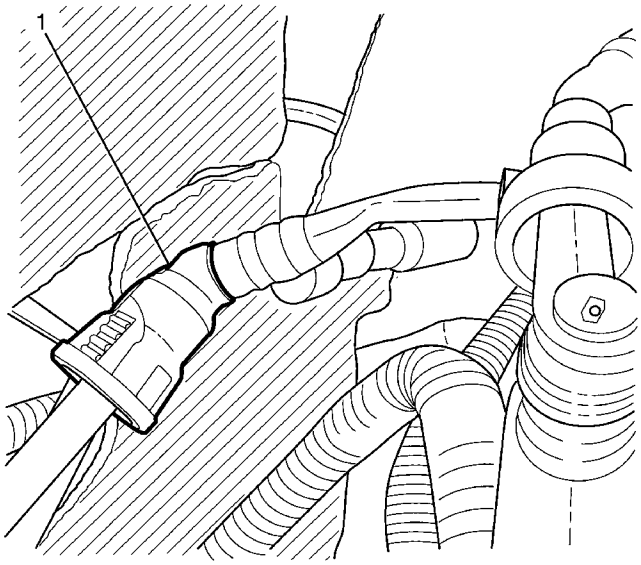
Removal Procedure

1. Remove the upper intake manifold. Refer to Upper Intake Manifold Replacement.

   Warning: Refer to Safety Glasses Warning in the Preface section.



2. Disconnect the emission purge pipe (1). Refer to Plastic Collar Quick Connect Fitting Service.



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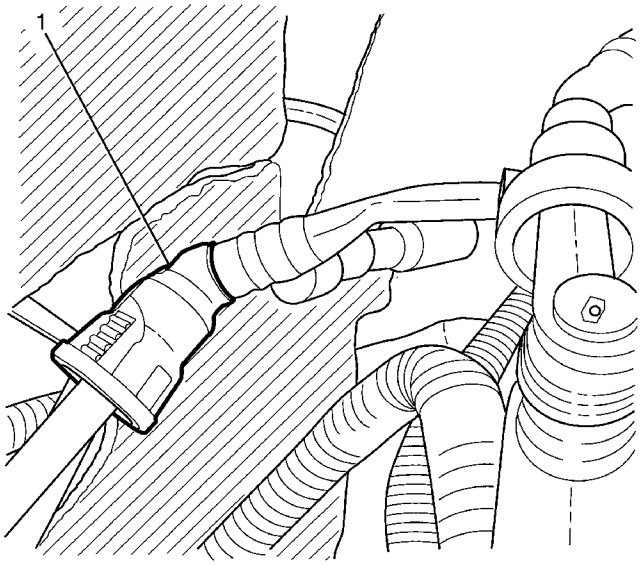
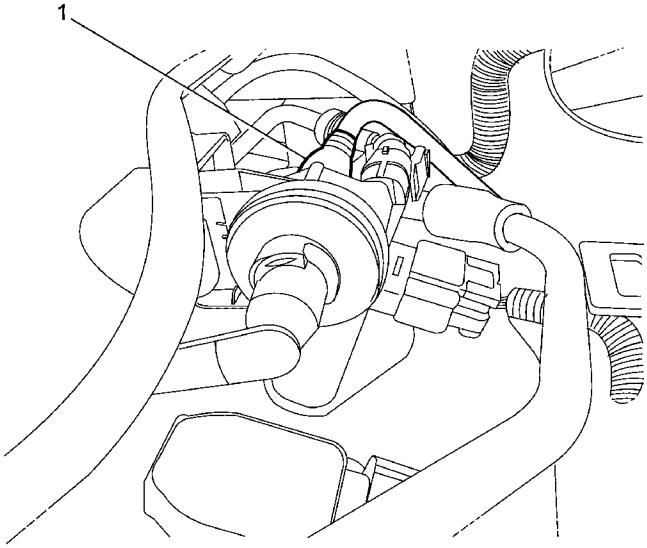
3. Disconnect the emission purge pipe. Refer to Plastic Collar Quick Connect Fitting Service.
4. Remove the emission purge pipe (1).

Installation Procedure



Note: Push the plastic quick connect fitting firmly on to the metal pipe. Listen for an audible click to confirm fitting.

1. Connect the emission purge pipe (1).



Note: Push the plastic quick connect fitting firmly on to the purge valve solenoid. Listen for an audible click to confirm fitting.

2. Connect the emission purge pipe (1).
3. Install the upper intake manifold. Refer to Upper Intake Manifold Replacement.

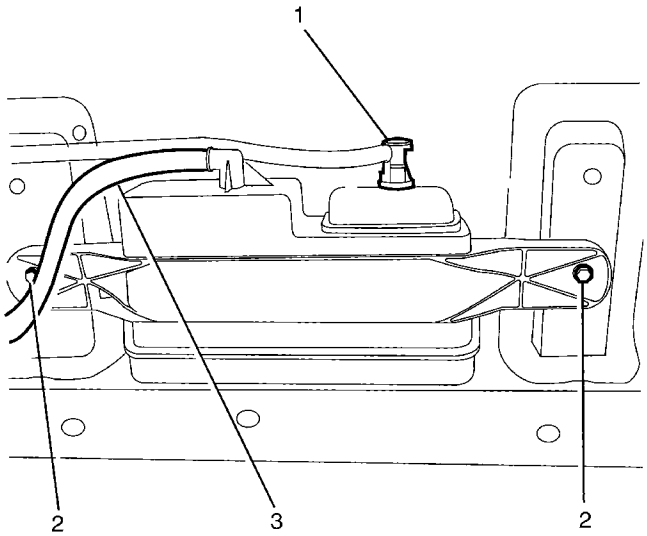
Evaporative Emission Canister Replacement

Removal Procedure

Warning: Refer to Safety Glasses Warning in the Preface section.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Remove the rear frame. Refer to Rear Frame Replacement.



2. Disconnect the evaporative emission (EVAP) hoses (1, 3) from the EVAP canister.
3. Remove the purge canister to chassis retaining bolts (2).

Installation Procedure

Caution: Refer to Fastener Caution in the Preface section.

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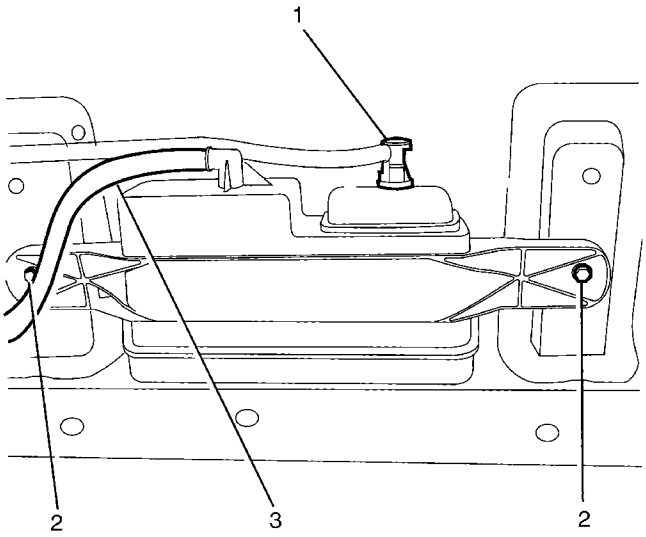
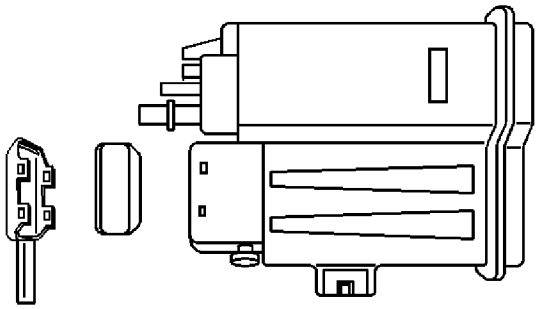


1. Install the purge canister to chassis retaining bolts (2) and tighten to **6 N·m (53 lb in)**.
2. Connect the EVAP hoses (1, 3) from the EVAP canister.
3. Install the rear frame. Refer to Rear Frame Replacement.

Evaporative Emission Canister Filter Replacement

Removal Procedure



1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle .
2. Using a 90 degree pick, disengage the lower filter cover clips.
3. Insert a flat-bladed tool between the filter cover and canister, and push up to disengage the upper clips.
4. Remove and discard the evaporative emission (EVAP) canister filter cover.
5. Remove and discard the EVAP canister filter.
6. Clean the inside of the EVAP canister filter housing with a clean shop towel.

Installation Procedure

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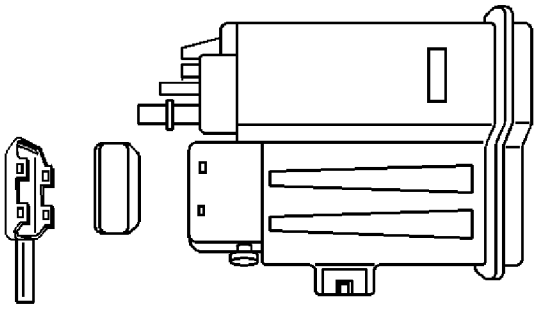


1. Insert a NEW EVAP canister filter into the EVAP canister.

   Important: Ensure the NEW seal is properly seated into the NEW cover.

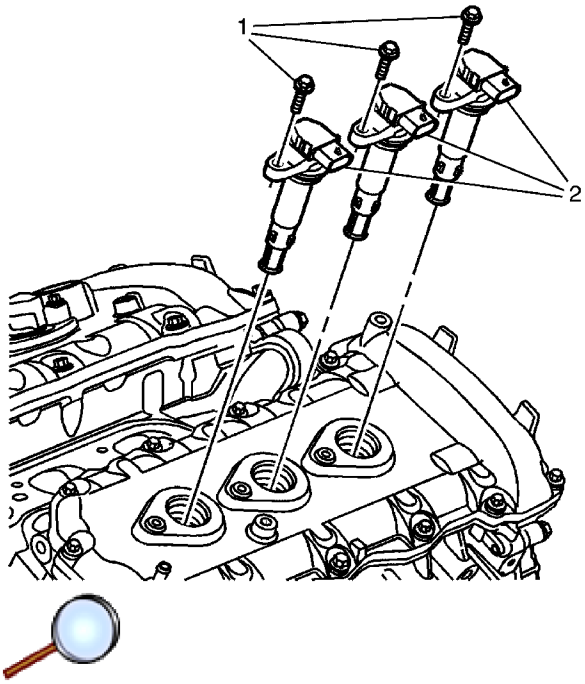
2. Install a NEW EVAP canister filter cover seal to a EVAP NEW canister cover.
3. Snap the EVAP canister filter cover onto the EVAP canister.
4. Lower the vehicle.

Ignition Coil Replacement - Bank 1

Removal Procedure

Warning: Refer to Safety Glasses Warning in the Preface section.

1. Turn the ignition OFF.
2. Remove the engine cover. Refer to Engine Cover Replacement.
3. Remove the upper intake manifold. Refer to Upper Intake Manifold Replacement.



4. Remove the ignition coil harness connector from the ignition coil.
5. Remove the ignition coil to camshaft cover retaining bolts (1).
6. Remove the ignition coils (2) from the vehicle.

Installation Procedure

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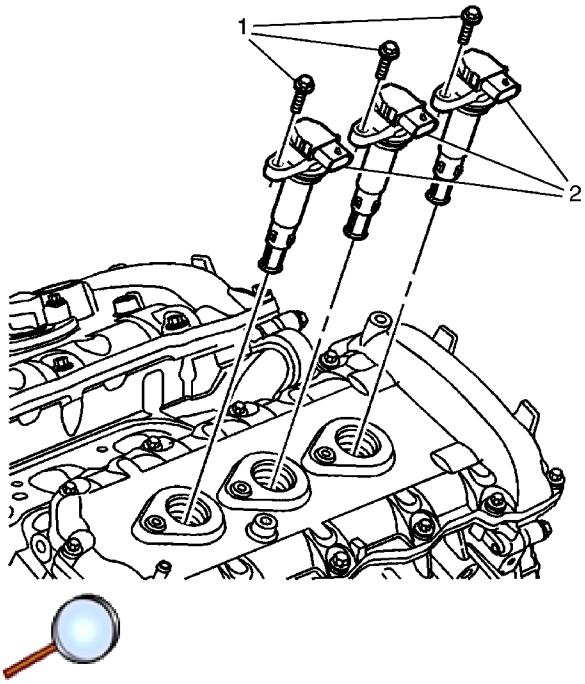


1. Install the ignition coil (2) to the engine.

   Caution: Refer to Fastener Caution in the Preface section.

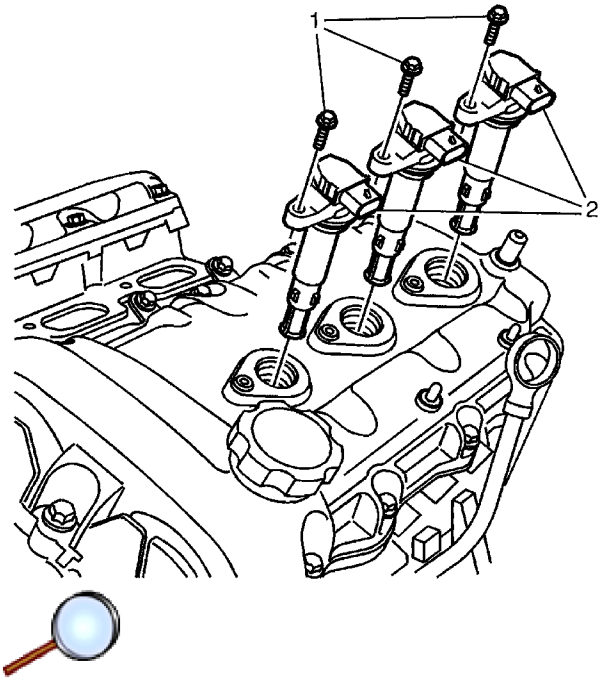
2. Install the ignition coil to camshaft cover retaining bolts (1) and tighten to **10 N·m (89 lb in)**.
3. Install the ignition coil harness connector to the ignition coil.
4. Install the upper intake manifold. Refer to Upper Intake Manifold Replacement.
5. Install the engine cover. Refer to Engine Cover Replacement.

Ignition Coil Replacement - Bank 2

Removal Procedure

Warning: Refer to Safety Glasses Warning in the Preface section.

1. Turn the ignition OFF.
2. Remove the engine cover. Refer to Engine Cover Replacement.
3. Remove the upper intake manifold. Refer to Upper Intake Manifold Replacement.



4. Remove the ignition coil harness connector from the ignition coil.
5. Remove the ignition coil to camshaft cover retaining bolts (1).
6. Remove the ignition coil from the vehicle (2).

Installation Procedure

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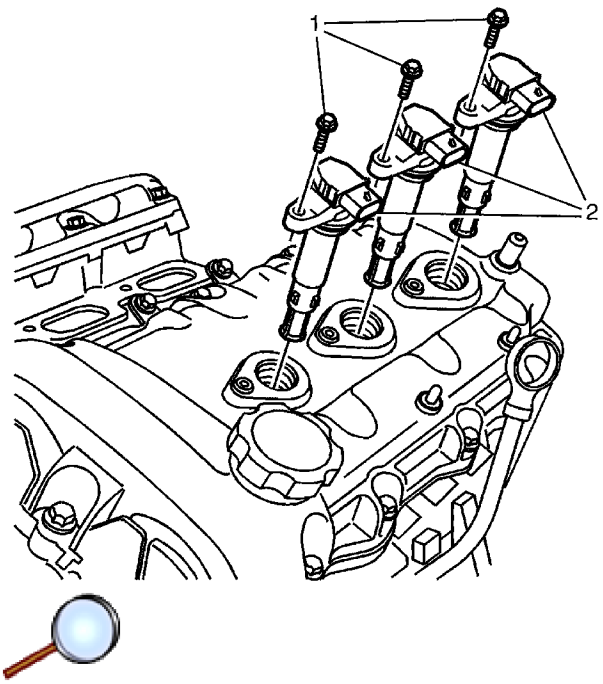


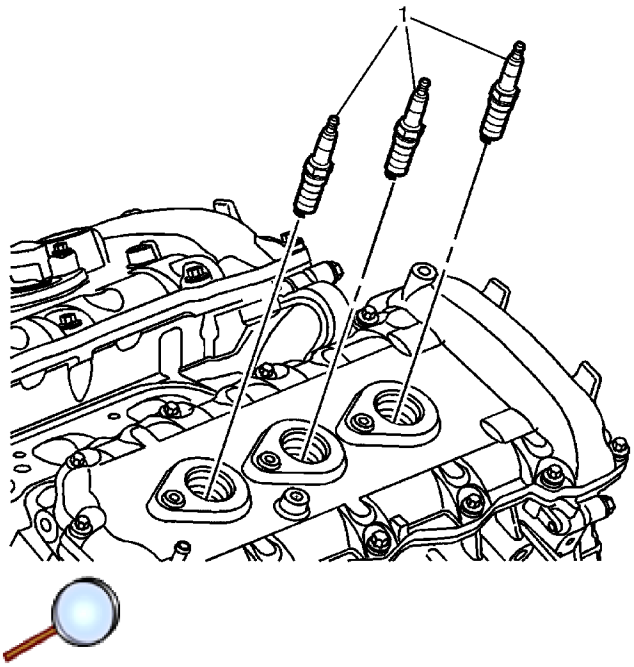
1. Install the ignition coils (2) to the engine.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the ignition coil to camshaft cover retaining bolts (1) and tighten to **10 N·m (89 lb in)**.
3. Install the ignition coil harness connector to the ignition coil.
4. Install the upper intake manifold. Refer to Upper Intake Manifold Replacement.
5. Install the engine cover. Refer to Engine Cover Replacement.

Spark Plug Replacement

Removal Procedure



1. Turn the ignition OFF.
2. Remove the ignition coil. Refer to Ignition Coil Replacement - Bank 1 and/or Ignition Coil Replacement - Bank 2.

   Warning: Refer to Safety Glasses and Compressed Air Warning in the Preface section.

   Caution: Clean the spark plug recess area before removing the spark plug. Failure to do so could result in engine damage because of dirt or foreign material entering the cylinder head, or by the contamination of the cylinder head threads. The contaminated threads may prevent the proper seating of the new plug. Use a thread chaser to clean the threads of any contamination.

3. Use compressed air in order to remove debris from the spark plug cavity.

   Caution: Allow the engine to cool before removing the spark plugs. Attempting to remove the spark plugs from a hot engine may cause the plug threads to seize, causing damage to cylinder head threads.

4. Remove the spark plugs (1) from the cylinder head.

Installation Procedure

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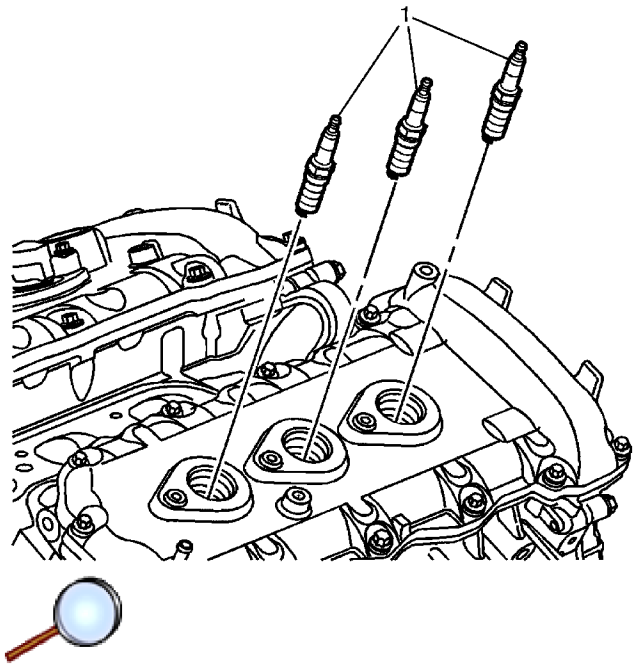


Caution: Use only the spark plugs specified for use in the vehicle. Do not install spark plugs that are either hotter or colder than those specified for the vehicle. Installing spark plugs of another type can severely damage the engine.

Caution: Check the gap of all new and reconditioned spark plugs before installation. The pre-set gaps may have changed during handling. Use a round feeler gage to ensure an accurate check. Installing the spark plugs with the wrong gap can cause poor engine performance and may even damage the engine.

1. Make sure that the spark plug gap is equivalent to the spark plug gap specification. Refer to Ignition System Specifications.

   Caution: Be sure that the spark plug threads smoothly into the cylinder head and the spark plug is fully seated. Use a thread chaser, if necessary, to clean threads in the cylinder head. Cross-threading or failing to fully seat the spark plug can cause overheating of the plug, exhaust blow-by, or thread damage.

2. Install the spark plug and tighten to **20 N·m (15 lb ft)**.
3. Install the ignition coil. Refer to Ignition Coil Replacement - Bank 1 and/or Ignition Coil Replacement - Bank 2.

Crankshaft Position Sensor Replacement

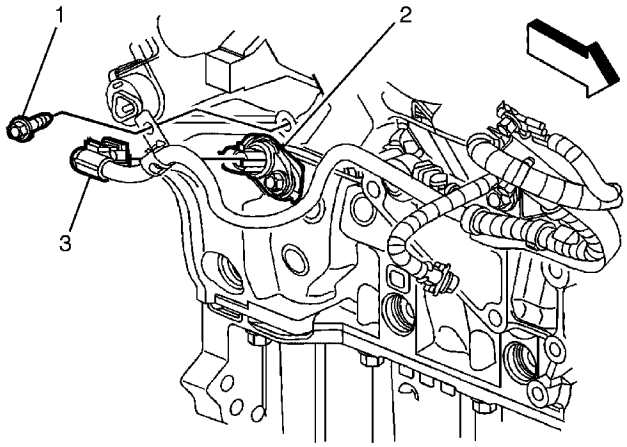
Removal Procedure

Warning: Refer to Safety Glasses Warning in the Preface section.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Turn the ignition OFF.

   Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.



2. Reposition the wiring harness heat shield to obtain access.
3. Disconnect the crankshaft position (CKP) harness connector (3) from the CKP.

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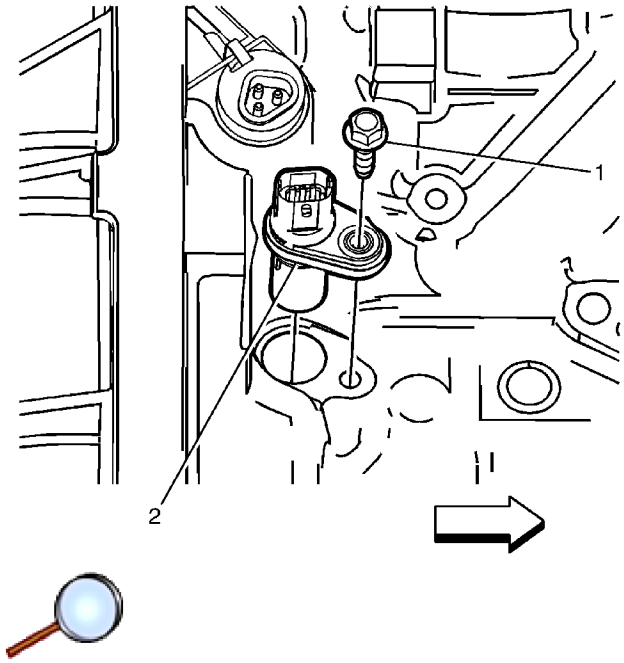
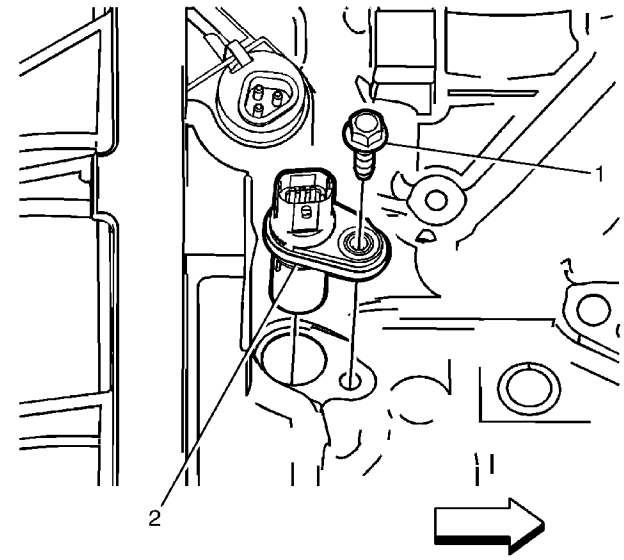


4. Remove the CKP to engine block retaining bolt (1) from the CKP sensor (2).
5. Remove the CKP sensor (2) from the engine block.

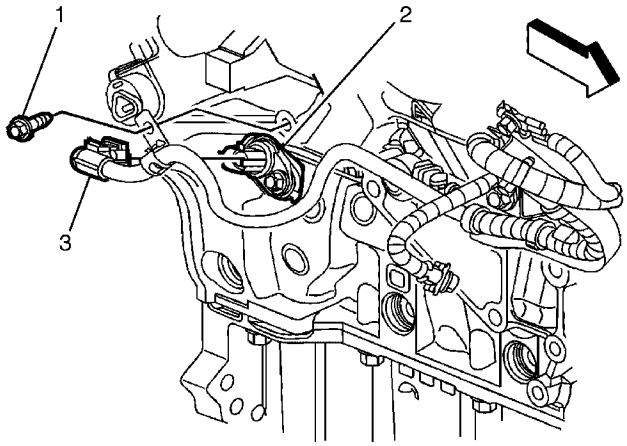
Installation Procedure



1. Install the CKP sensor (2) to the engine block.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the CKP sensor to engine block retaining bolt (1) and tighten to **10 N·m (89 lb in)**.



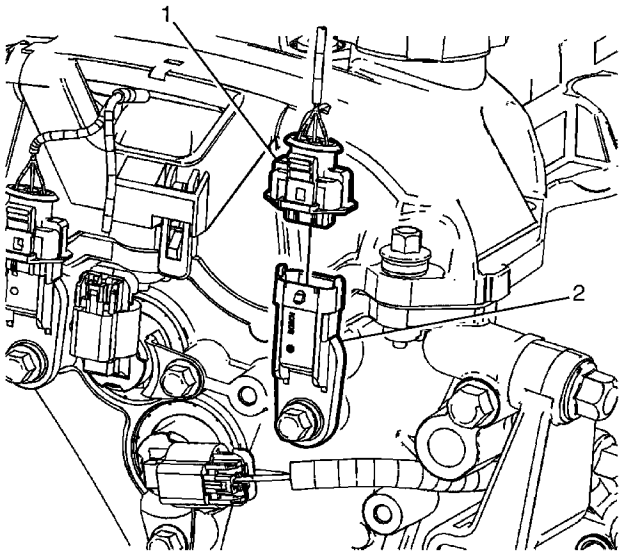
3. Connect the CKP electrical connector (3) to the CKP sensor.
4. Lower the vehicle.

Camshaft Position Sensor Replacement - Bank 2 (Left Side) Exhaust

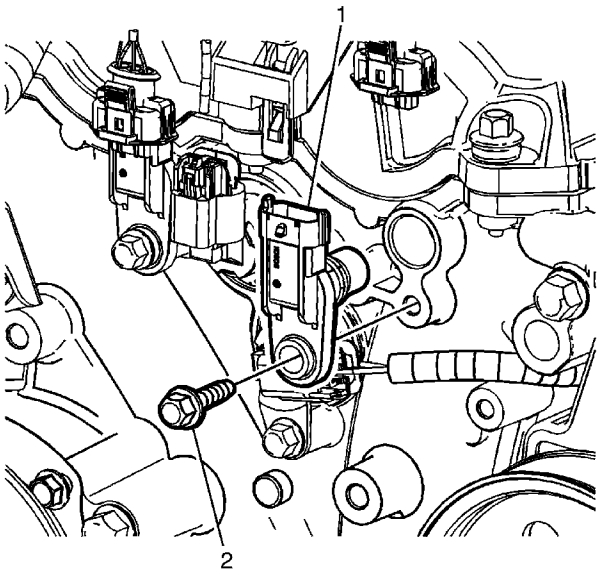
Removal Procedure

Note: Do not disconnect the power steering fluid lines/hoses from the reservoir.

1. Remove the power steering fluid reservoir bolts and reposition the power steering fluid reservoir in order to provide access. Refer to Power Steering Fluid Reservoir Replacement.



2. Remove the camshaft position (CMP) sensor electrical connector (1) from the CMP sensor (2).



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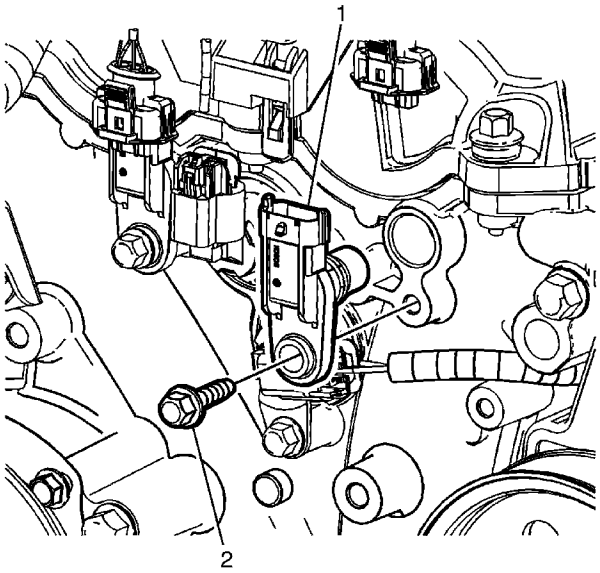
3. Remove the CMP sensor to engine front cover retaining bolt (1).
4. Remove the CMP sensor (2) from the engine front cover.

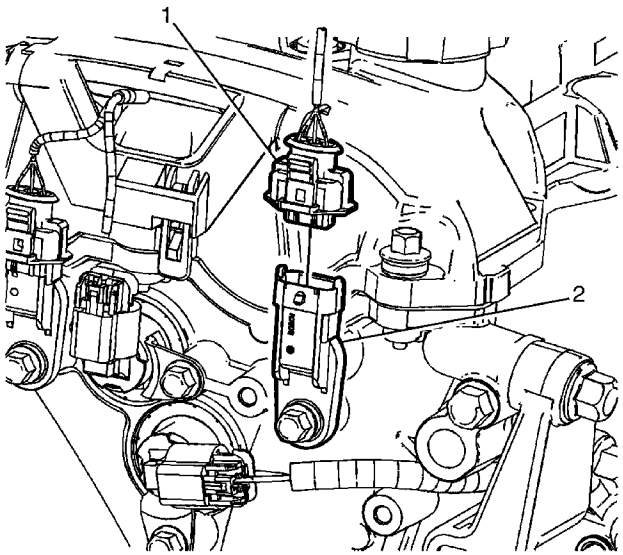
Installation Procedure



1. Install the CMP sensor to the engine front cover.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the CMP sensor to engine front cover retaining bolt (1) and tighten to **10 N·m (89 lb in)**.



3. Install the CMP sensor electrical connector (1) to the CMP sensor (2).
4. Install the power steering fluid reservoir. Refer to Power Steering Fluid Reservoir Replacement.

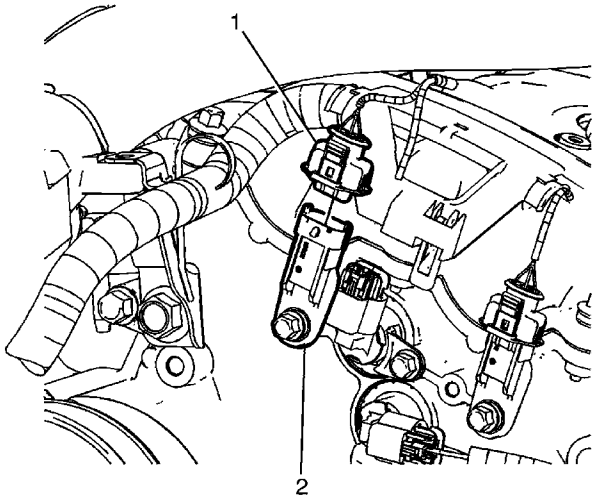
Camshaft Position Sensor Replacement - Bank 2 (Left Side) Intake

Removal Procedure

1. Turn the ignition OFF.

   Note: Do not disconnect the power steering fluid lines/hoses from the reservoir.

2. Remove the power steering fluid reservoir bolts and reposition the power steering fluid reservoir in order to provide access. Refer to Power Steering Fluid Reservoir Replacement.



3. Remove the camshaft position (CMP) sensor electrical connector (1) from the CMP sensor (2).

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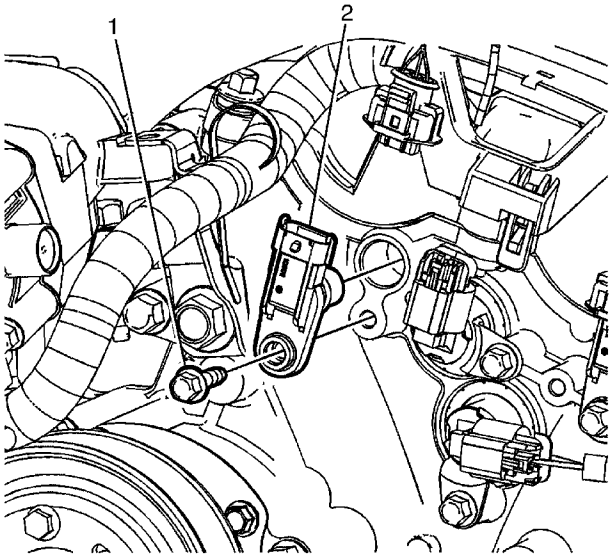
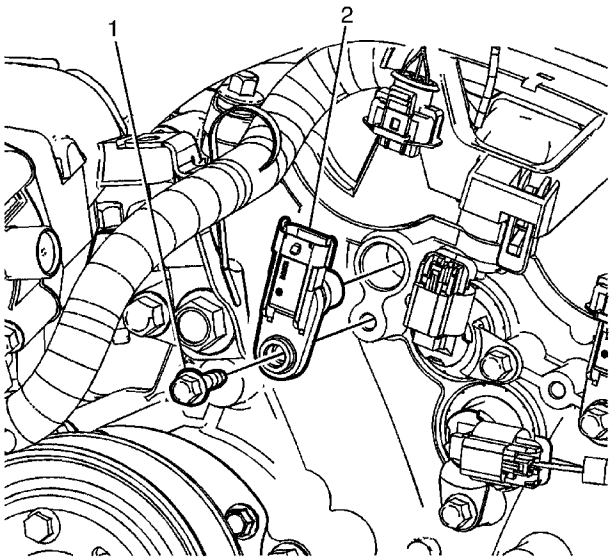


4. Remove the CMP sensor to engine front cover retaining bolt (1).
5. Remove the CMP sensor (2) from the engine front cover.

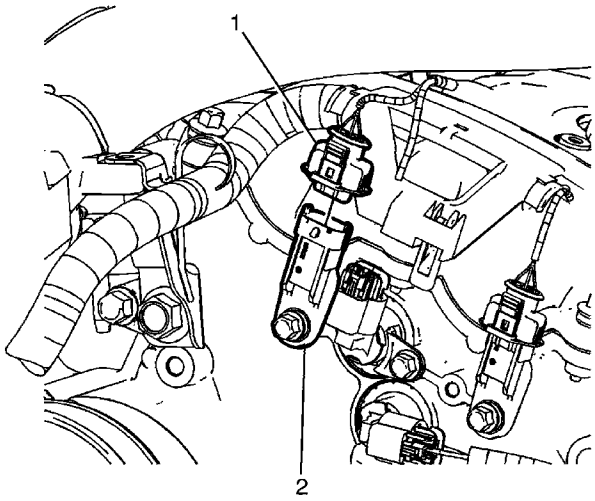
Installation Procedure



1. Install the CMP sensor (2) to the engine front cover.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the CMP sensor to engine front cover retaining bolt (1) and tighten to **10 N·m (89 lb in)**.



3. Install the CMP sensor electrical connector (1) to the CMP sensor (2).
4. Install the power steering fluid reservoir. Refer to Power Steering Fluid Reservoir Replacement.

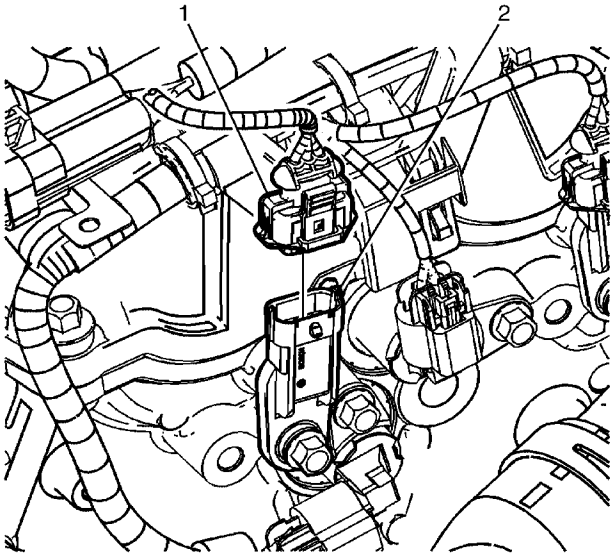
Camshaft Position Sensor Replacement - Bank 1 (Right Side) Exhaust

Removal Procedure

1. Turn the ignition OFF.

   Note: Do not remove the engine control module (ECM) from the ECM bracket.

2. Remove the remote earth post bracket to engine front cover retaining bolts and reposition the remote earth post bracket in order to provide access.



3. Remove the camshaft position (CMP) sensor electrical connector (1) from the CMP sensor (2).

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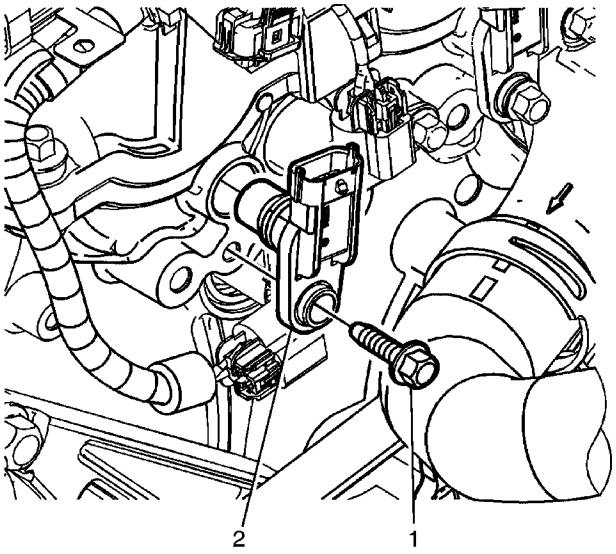
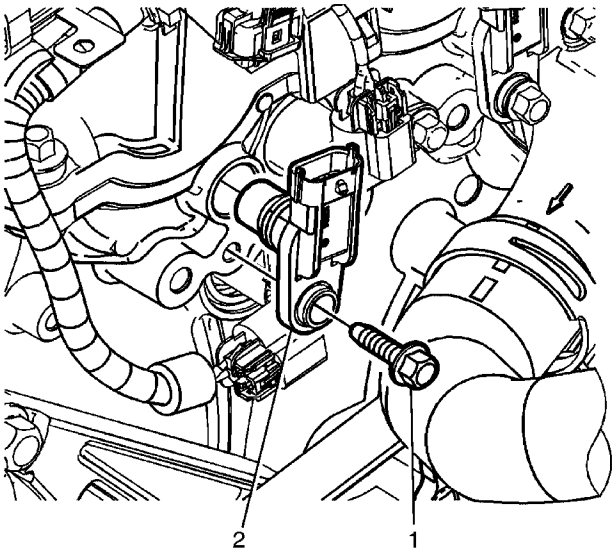


4. Remove the CMP sensor to engine front cover retaining bolt (1).
5. Remove the CMP sensor (2) from the engine front cover.

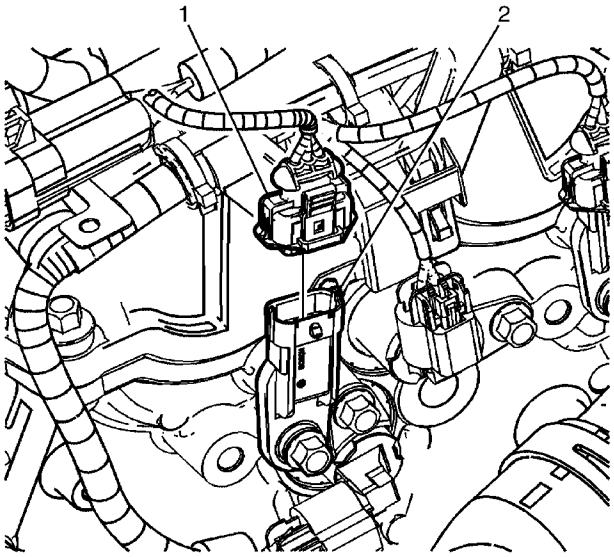
Installation Procedure



1. Install the CMP sensor (2) to the engine front cover.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the CMP sensor to engine front cover retaining bolt (1) and tighten to **10 N·m (89 lb in)**.

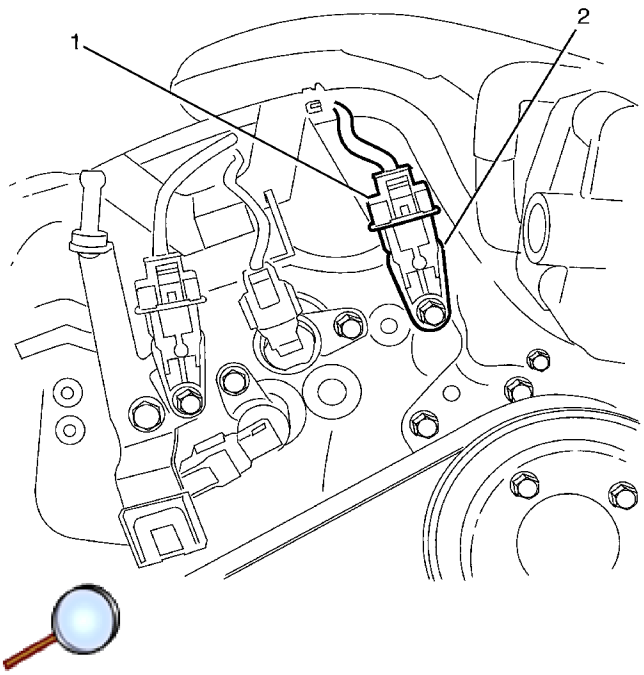


3. Install the CMP sensor electrical connector (1) to the CMP sensor (2).
4. Install the remote earth post bracket to engine front cover retaining bolts and tighten to **10 N·m (89 lb in)**.

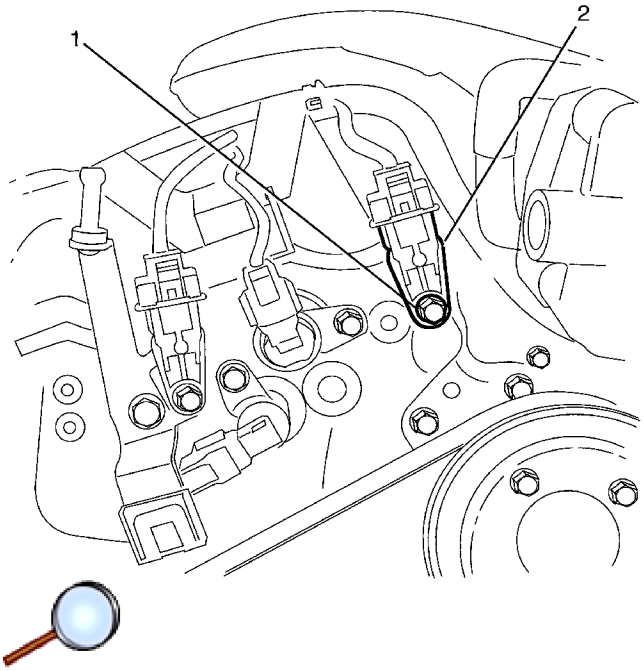
Camshaft Position Sensor Replacement - Bank 1 (Right Side) Intake

Removal Procedure

1. Turn the ignition OFF.



2. Remove the camshaft position (CMP) sensor electrical connector (1) from the CMP sensor (2).



3. Remove the CMP sensor to engine front cover retaining bolt (1).

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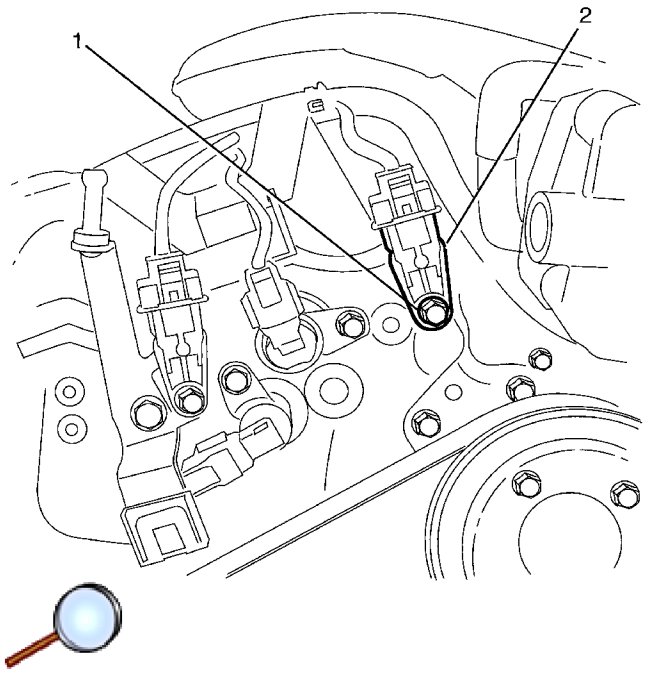
4. Remove the CMP sensor from the engine front cover (2).

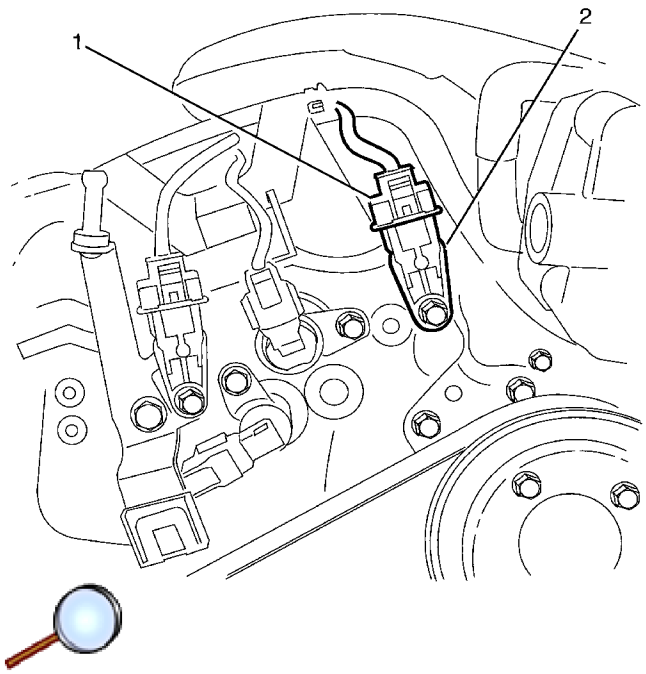
Installation Procedure



1. Install the CMP sensor (2) to the engine front cover.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the CMP sensor to engine front cover retaining bolt (1) and tighten to **10 N·m (89 lb in)**.



3. Install the CMP sensor electrical connector (1) to the CMP sensor.

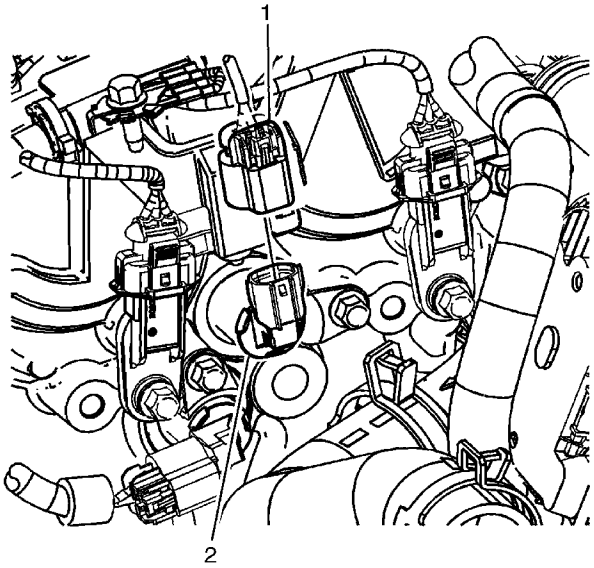
Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 (Right Side) Intake

Removal Procedure

1. Turn the ignition OFF.

   Note: Do not remove the engine control module (ECM) from the ECM bracket.

2. Remove the remote earth post bracket to engine front cover retaining bolts.



3. Remove the camshaft position (CMP) actuator valve electrical connector (1) from the CMP sensor (2).

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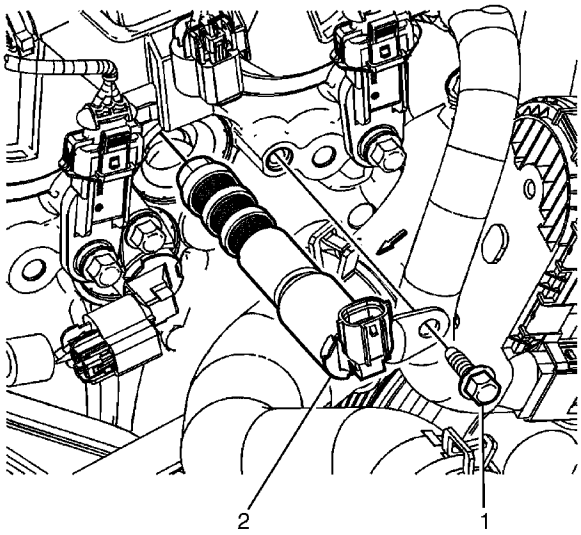
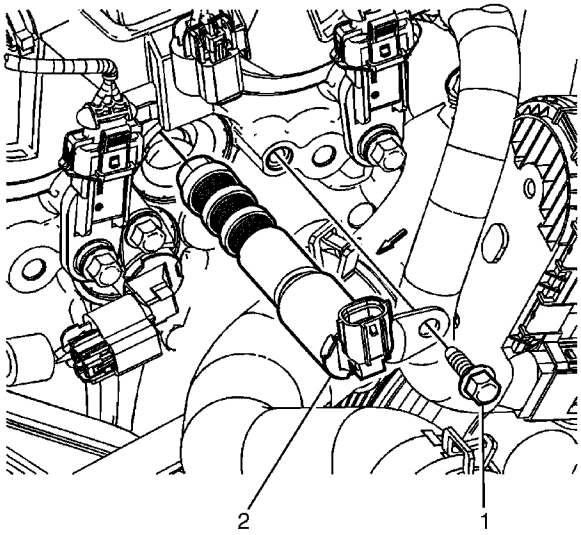


4. Remove the CMP actuator solenoid valve to engine front cover retaining bolt (1).
5. Remove the CMP actuator valve (2) from the engine front cover.
6. Inspect the CMP actuator valve seal and replace as necessary.

Installation Procedure

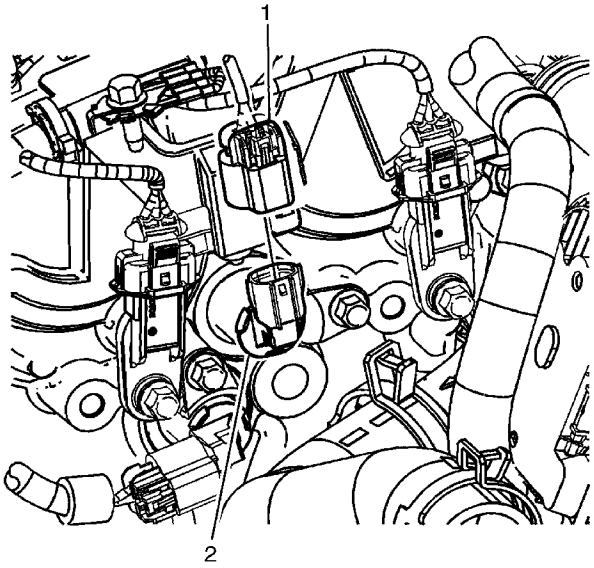
1. Inspect the CMP actuator valve seal for damage. Replace the seal if necessary.



2. Install the CMP actuator valve (2) to the engine front cover.

   Caution: Refer to Fastener Caution in the Preface section.

3. Install the CMP actuator solenoid valve to engine front cover retaining bolt (1) and tighten to **10 N·m (89 lb in)**.

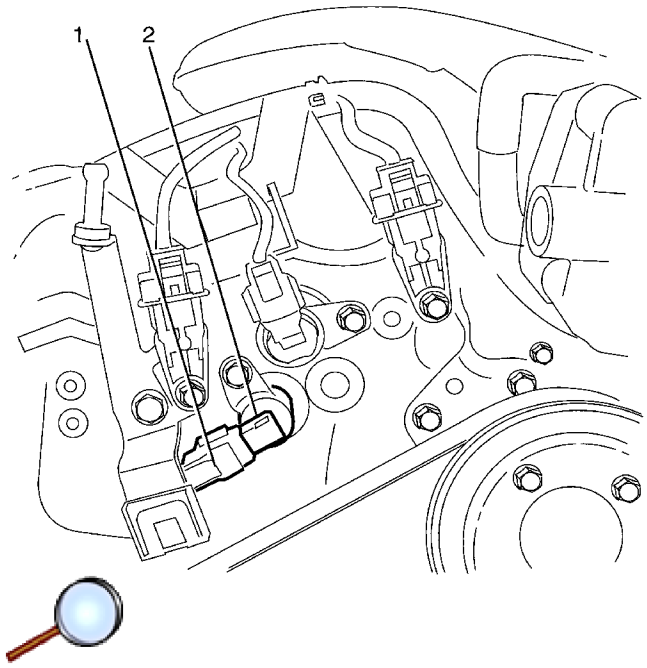


4. Install the CMP actuator valve electrical connector (1) to the CMP sensor (2).
5. Install the remote earth post bracket to engine front cover retaining bolts.

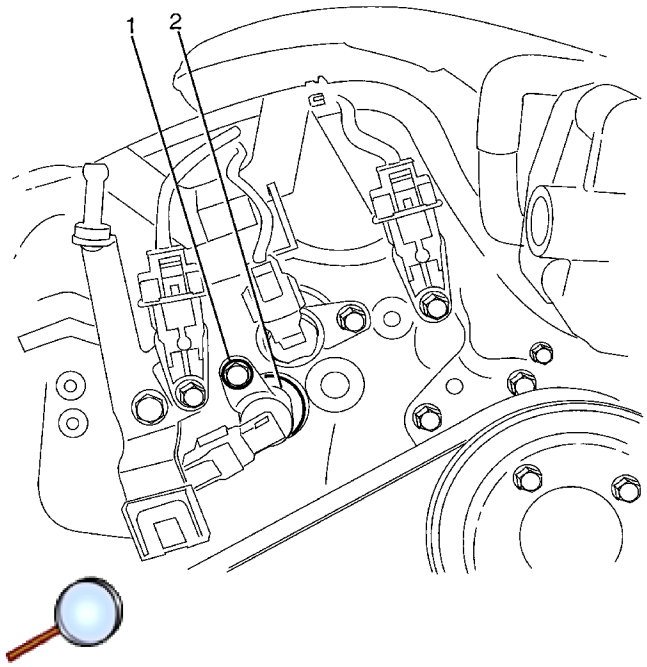
Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 1 (Right Side) Exhaust

Removal Procedure

1. Turn the ignition OFF.



2. Remove the camshaft position (CMP) actuator valve electrical connector (1) from the CMP (2).



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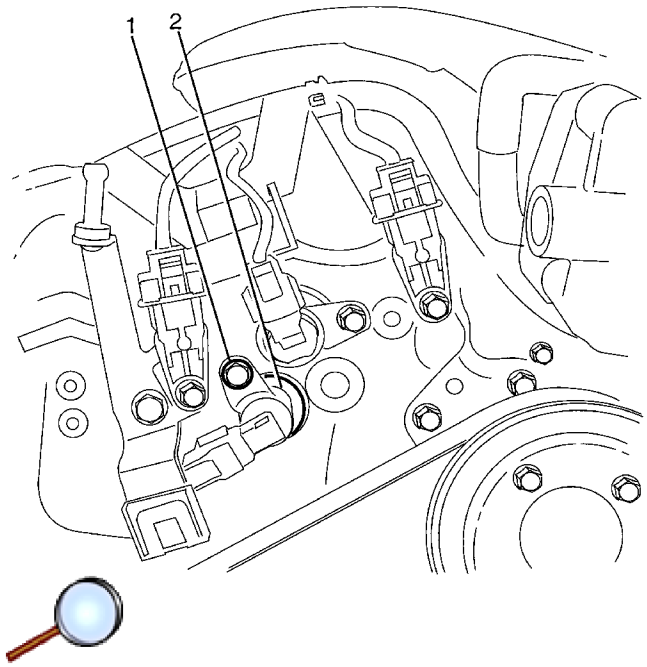
3. Remove the CMP actuator solenoid valve to engine front cover retaining bolt (1).
4. Remove the CMP actuator valve (2).
5. Inspect the CMP actuator valve seal and replace as necessary.

Installation Procedure

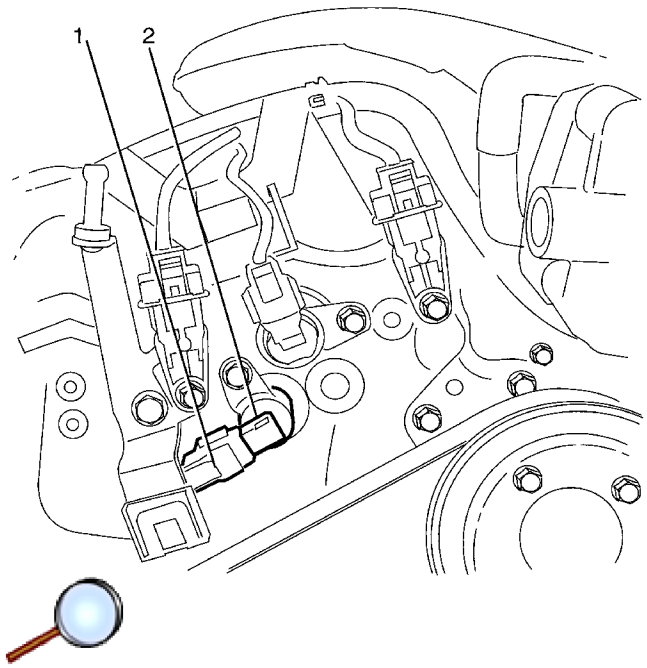
1. Inspect the CMP actuator valve seal for damage. Replace the seal if necessary.



2. Install the CMP actuator valve (2) to the engine front cover.

   Caution: Refer to Fastener Caution in the Preface section.

3. Install the CMP actuator solenoid valve to engine front cover retaining bolt (1) and tighten to **10 N·m (89 lb in)**.



4. Install the CMP valve electrical connector (1) to the CMP actuator valve.

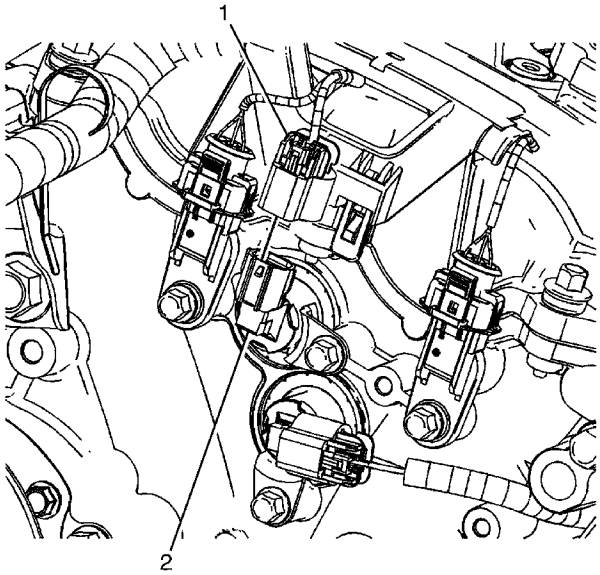
Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 (Left Side) Intake

Removal Procedure

1. Turn the ignition OFF.

   Note: Do not disconnect the power steering fluid lines/hoses from the reservoir.

2. Remove the power steering fluid reservoir bolts and reposition the power steering fluid reservoir in order to provide access. Refer to Power Steering Fluid Reservoir Replacement.



3. Remove the camshaft position (CMP) actuator valve electrical connector (1) from the CMP actuator (2).

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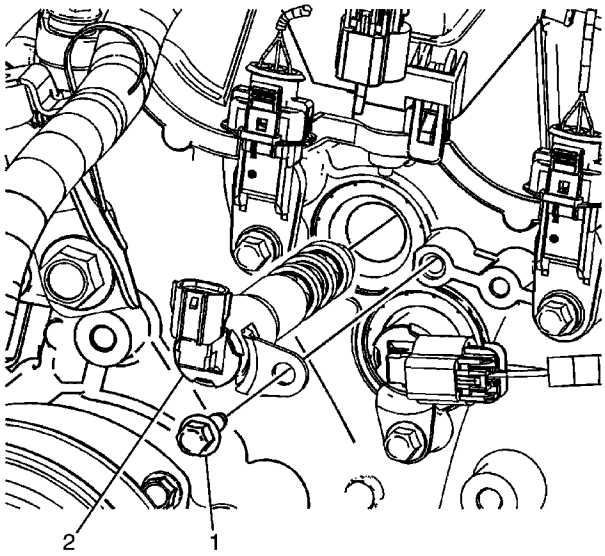
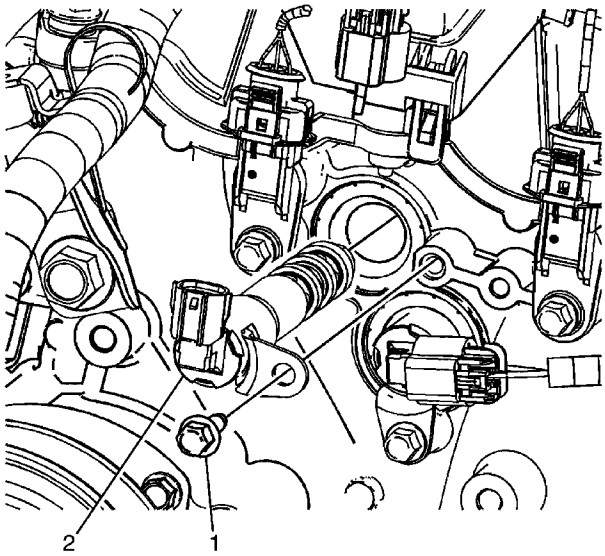


4. Remove the CMP actuator solenoid valve to engine front cover retaining bolt (1).
5. Remove the CMP actuator valve (2) from the engine front cover.
6. Inspect the CMP actuator valve seal for damage and replace as necessary.

Installation Procedure

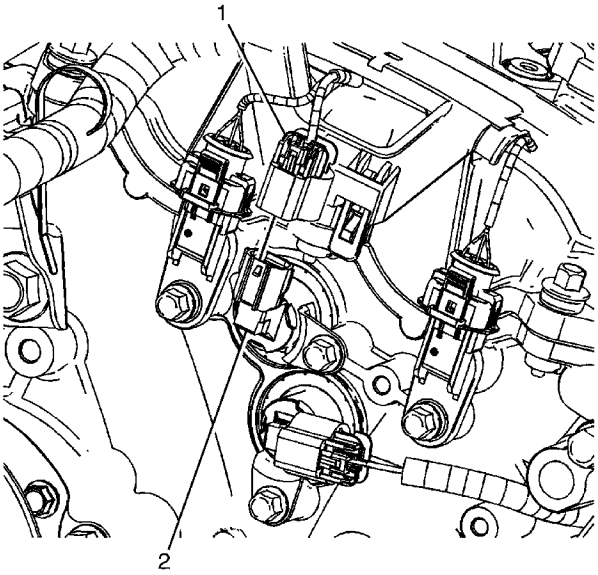
1. Inspect the CMP actuator valve seal for damage. Replace the seal if necessary.



2. Install the CMP actuator valve (2) to the engine front cover.

   Caution: Refer to Fastener Caution in the Preface section.

3. Install the CMP actuator solenoid valve to engine front cover retaining bolt (1) and tighten to **10 N·m (89 lb in)**.



4. Install the CMP actuator valve electrical connector (1) to the CMP actuator valve (2).
5. Install the power steering fluid reservoir. Refer to Power Steering Fluid Reservoir Replacement.

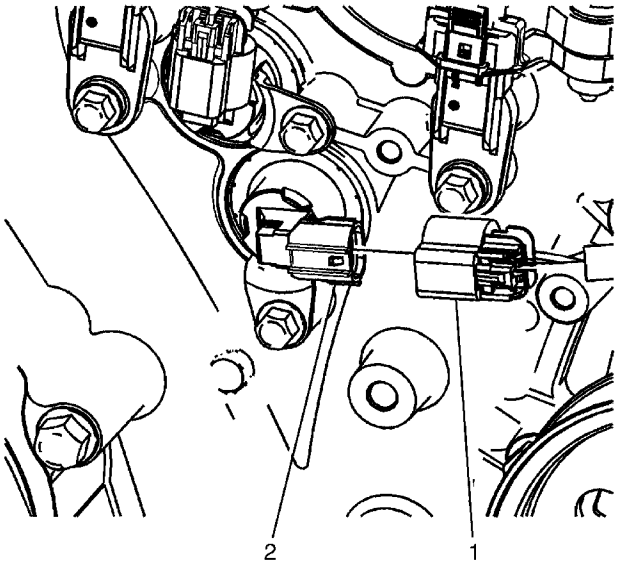
Camshaft Position Actuator Solenoid Valve Solenoid Replacement - Bank 2 (Left Side) Exhaust

Removal Procedure

1. Turn the ignition OFF.

   Note: Do not disconnect the power steering fluid lines/hoses from the reservoir.

2. Remove the power steering fluid reservoir bolts and reposition the power steering fluid reservoir in order to provide access. Refer to Power Steering Fluid Reservoir Replacement.



3. Remove the camshaft position (CMP) actuator valve electrical connector (1) from the CMP actuator valve (2).

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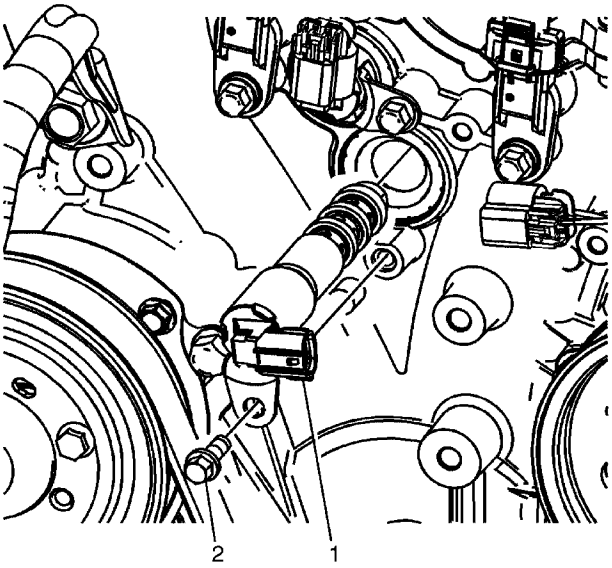
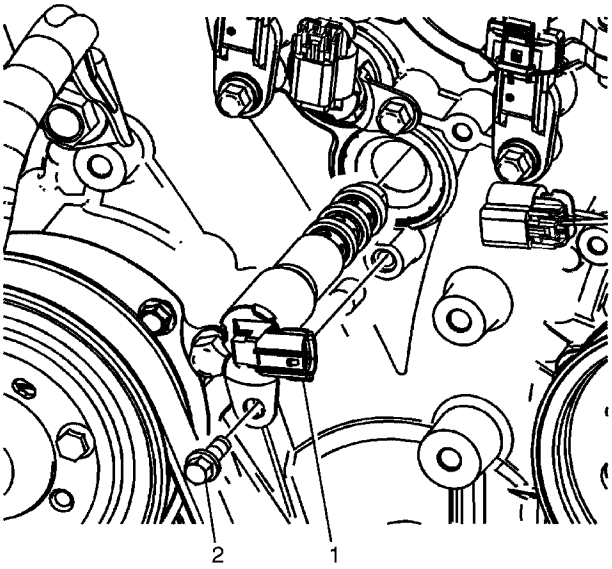


4. Remove the CMP actuator solenoid valve to engine front cover retaining bolt (1).
5. Remove the CMP actuator valve (2) from the engine front cover.
6. Inspect the CMP actuator valve seal for damage and replace as necessary.

Installation Procedure

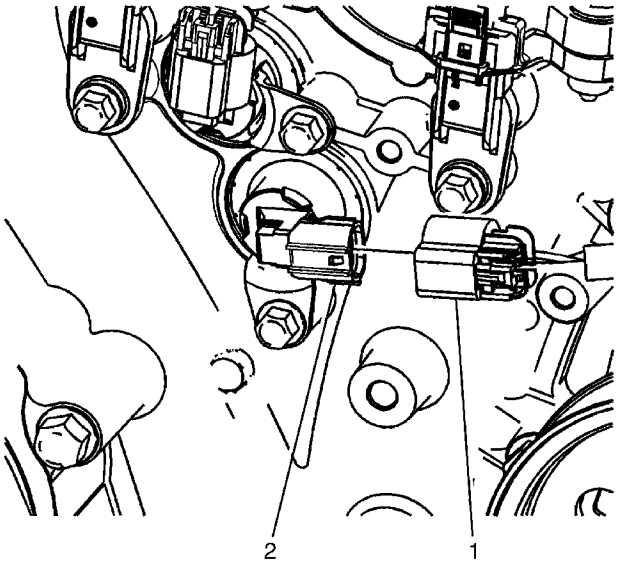
1. Inspect the CMP actuator valve seal for damage. Replace the seal if necessary.



2. Install the CMP actuator valve (2) to the engine front cover.

   Caution: Refer to Fastener Caution in the Preface section.

3. Install the CMP actuator solenoid valve to engine front cover retaining bolt (1) and tighten to **10 N·m (89 lb in)**.

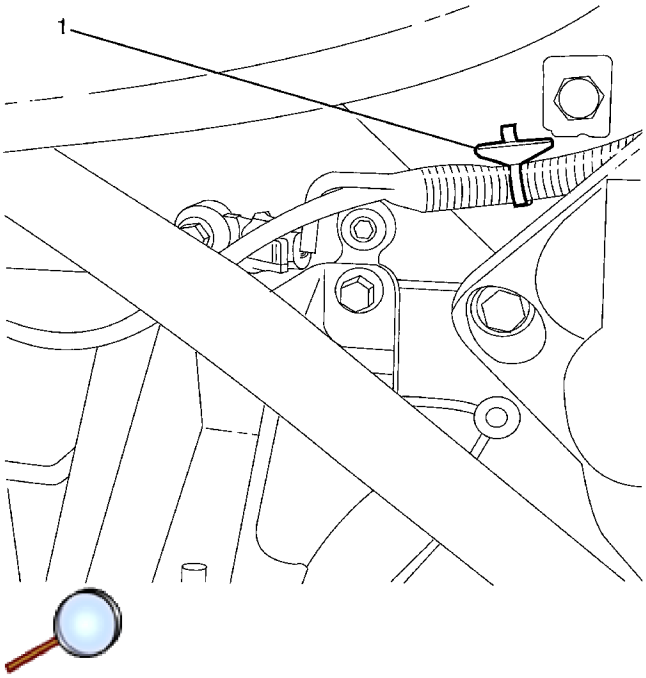


4. Install the CMP actuator valve electrical connector (1) to the CMP actuator valve (2).
5. Install the power steering fluid reservoir. Refer to Power Steering Fluid Reservoir Replacement.

Knock Sensor Replacement - Bank 1

Removal Procedure

Warning: Refer to Safety Glasses Warning in the Preface section.



Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Disconnect the wiring harness retaining clip (1).

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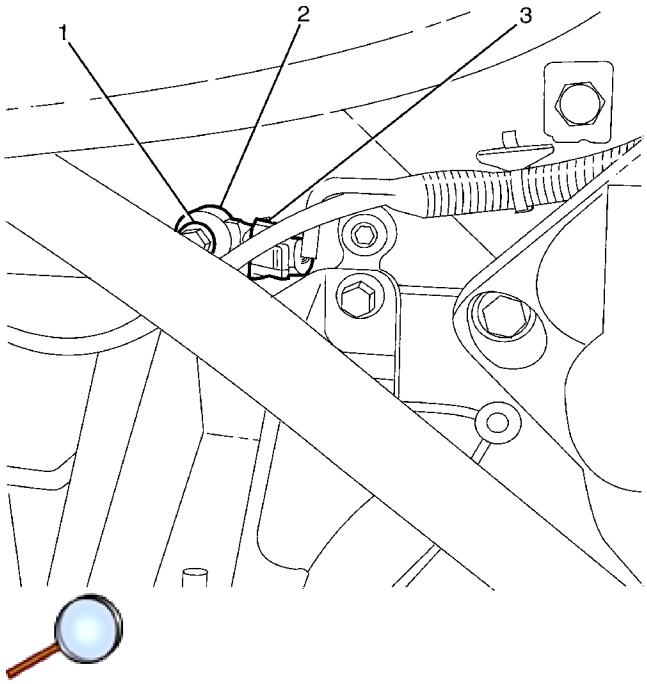
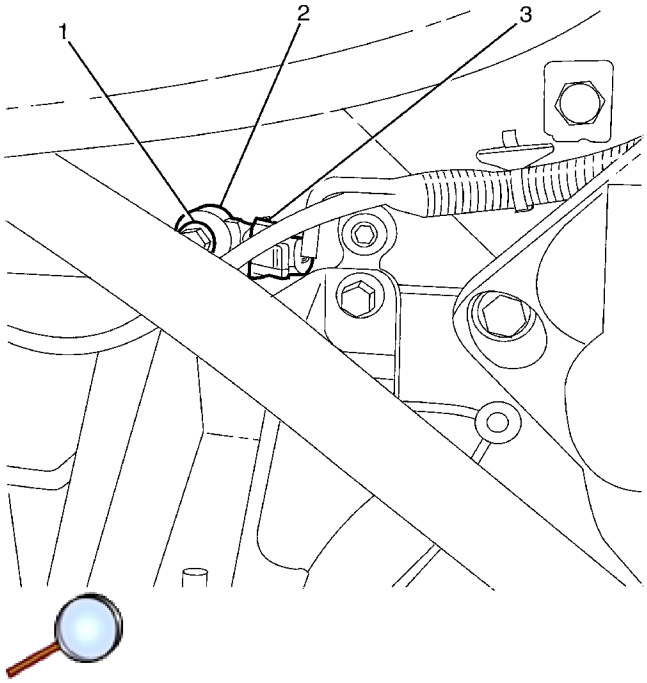


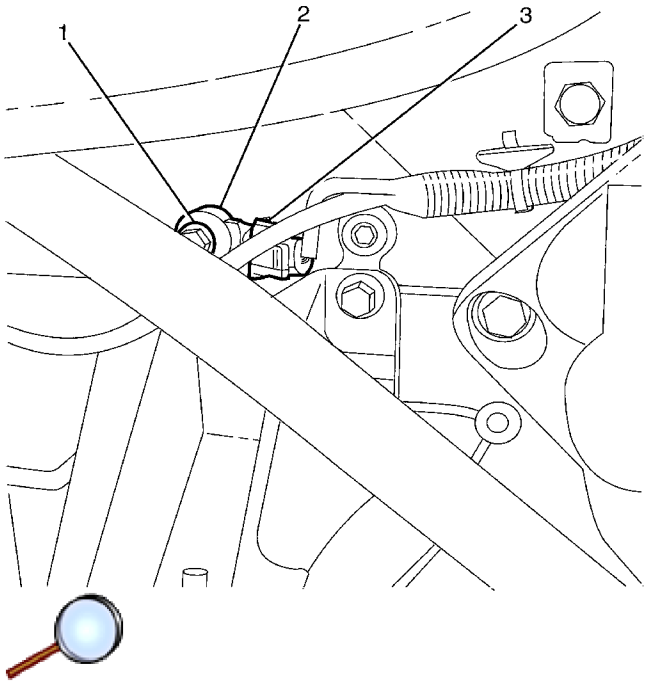
3. Remove the knock sensor (KS) electrical (1) connector from the KS (2).
4. Remove the KS (3) to engine block retaining bolt (2).

Installation Procedure

Caution: Refer to Fastener Caution in the Preface section.



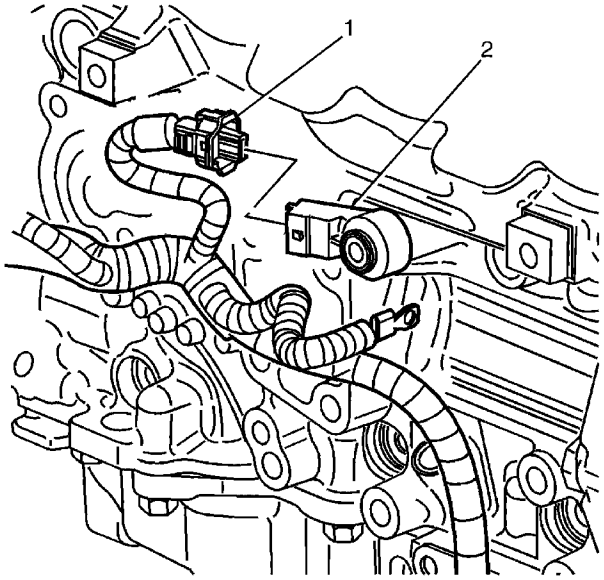
1. Install the KS (3) to engine block retaining bolt (2) and tighten to **23 N·m (17 lb ft)**.



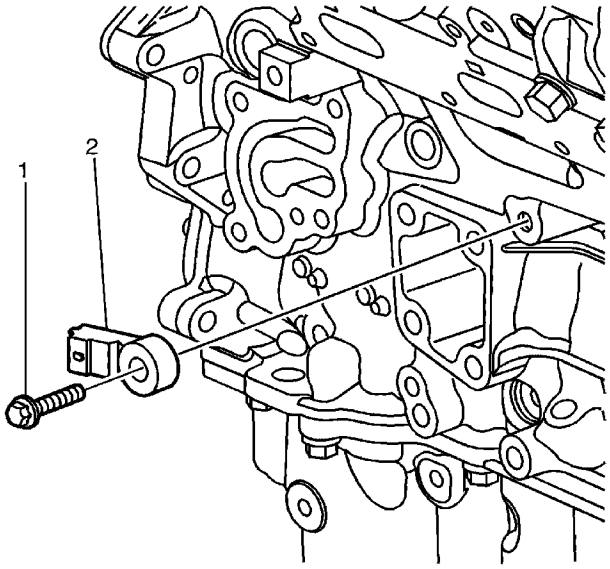
2. Install the knock sensor (KS) electrical (1) connector to the KS (2).
3. Lower the vehicle.

Knock Sensor Replacement - Bank 2

Removal Procedure



1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the knock sensor (KS) electrical connector (1) from the KS (2).



3. Remove the KS to engine block retaining bolt (1) from the KS.
4. Remove the KS (2) from the engine.

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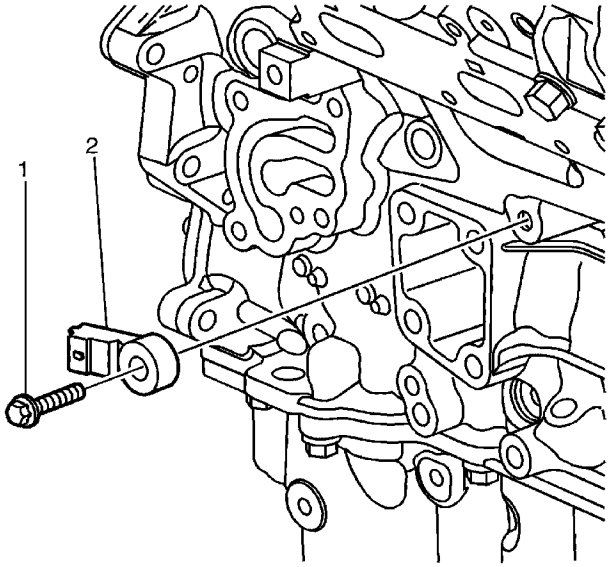
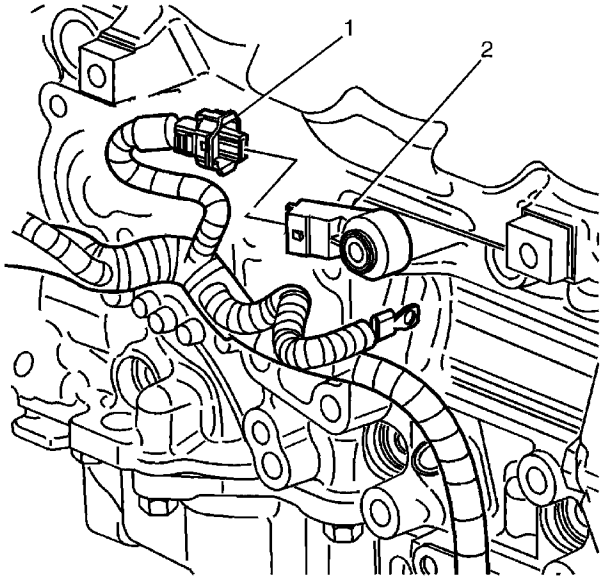
Installation Procedure



1. Install the KS (2) to the engine.

   Caution: Refer to Fastener Caution in the Preface section.

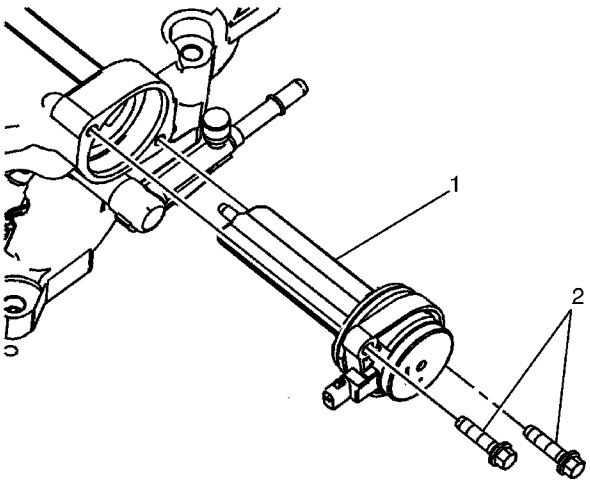
2. Install the KS to engine block retaining bolt (1) and tighten to **23 N·m (17 lb ft)**.



3. Install the KS electrical connector (1) to the KS (2).
4. Lower the vehicle.

Intake Manifold Runner Control Solenoid Replacement

Removal Procedure



Note: DO NOT separate the upper intake manifold from the lower intake manifold.

1. Remove the upper intake manifold with the lower intake manifold. Refer to Lower Intake Manifold Replacement.
2. Remove the intake manifold runner control solenoid to intake manifold retaining bolts (2) from the intake manifold runner control solenoid (1).
3. Remove the intake manifold runner control solenoid (1) from the manifold.

Installation Procedure

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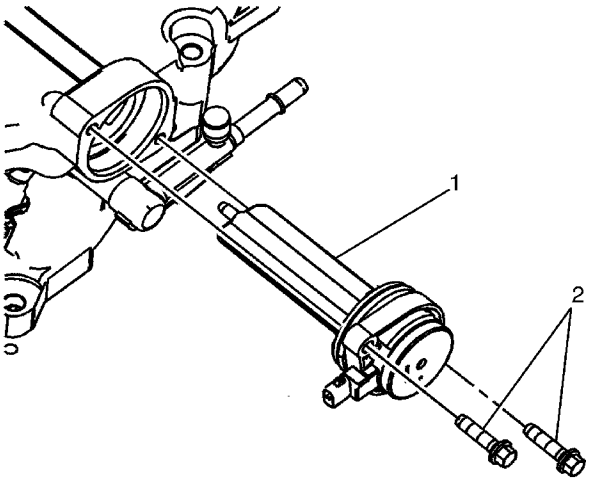


1. Install the intake manifold runner control solenoid (1) to the manifold.

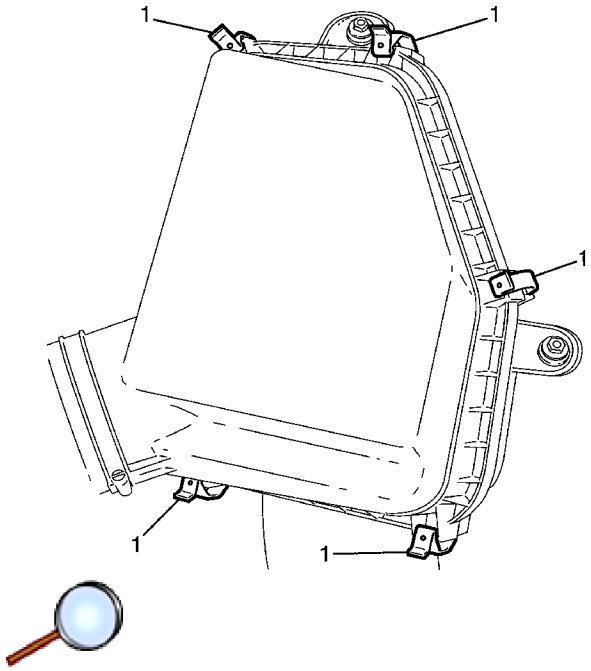
   Caution: Refer to Fastener Caution in the Preface section.

2. Install the intake manifold runner control solenoid to manifold retaining bolts (2) to intake manifold runner control solenoid and tighten to **10 N·m (89 lb in)**.
3. Install the upper intake manifold. Refer to Lower Intake Manifold Replacement.

Air Cleaner Element Replacement

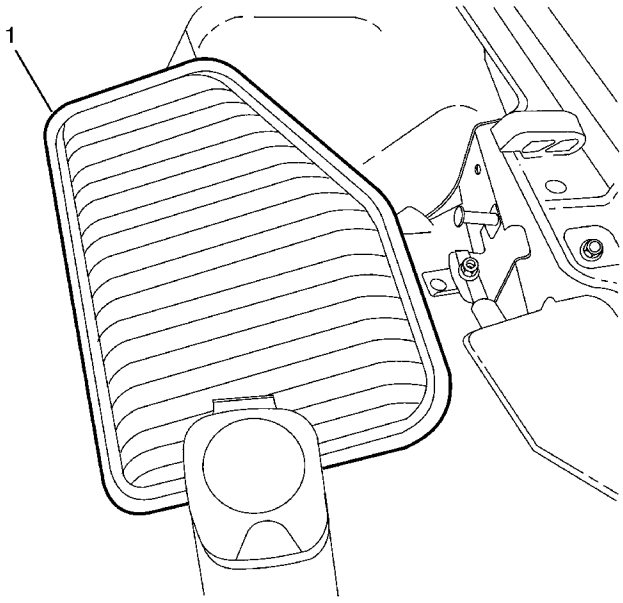
Removal Procedure

1. Remove the air cleaner intake duct. Refer to Air Cleaner Inlet Duct Replacement.



2. Release the air cleaner cover retaining clips (1) and remove the air cleaner element from the air filter assembly.

Installation Procedure



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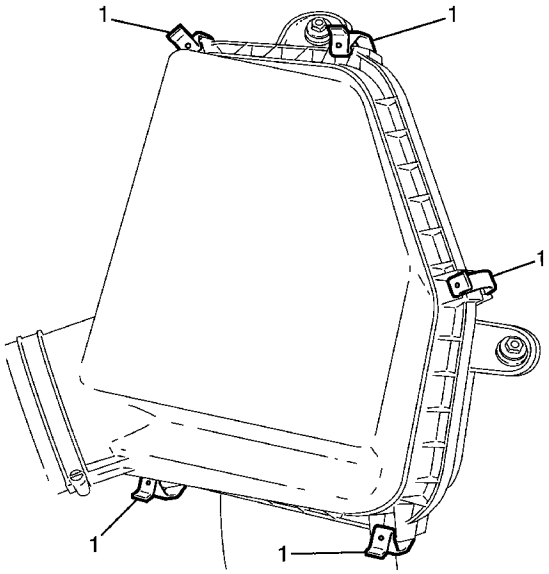
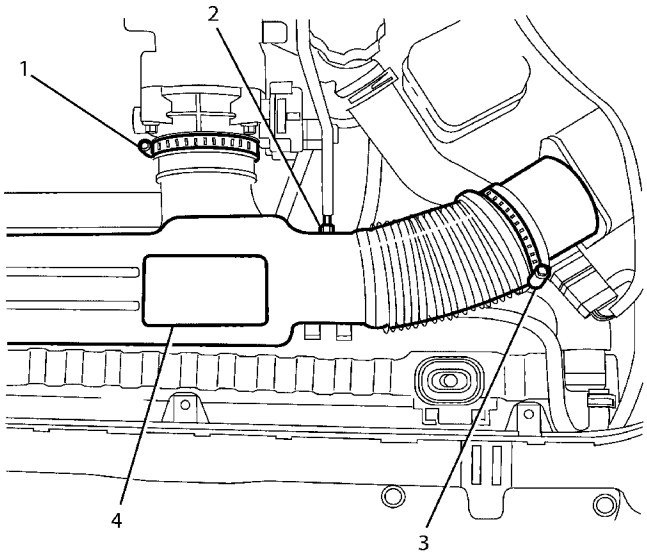
1. Install the air cleaner element (1) to the air cleaner assembly.



2. Install the air cleaner cover retaining clips (1) .
3. Install the air cleaner intake duct. Refer to Air Cleaner Inlet Duct Replacement.

Air Cleaner Inlet Duct Replacement

Removal Procedure



1. Remove the positive crankcase ventilation (PCV) hose (2) from the air cleaner duct resonator (4).
2. Remove the air cleaner duct to throttle body retaining clamp (1).
3. Remove the air cleaner duct to air cleaner assembly clamp (3)
4. Remove the air cleaner duct (4).

Installation Procedure

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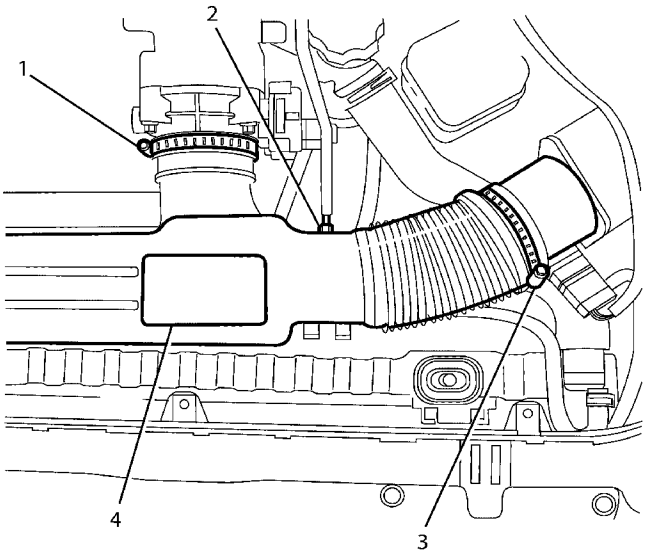


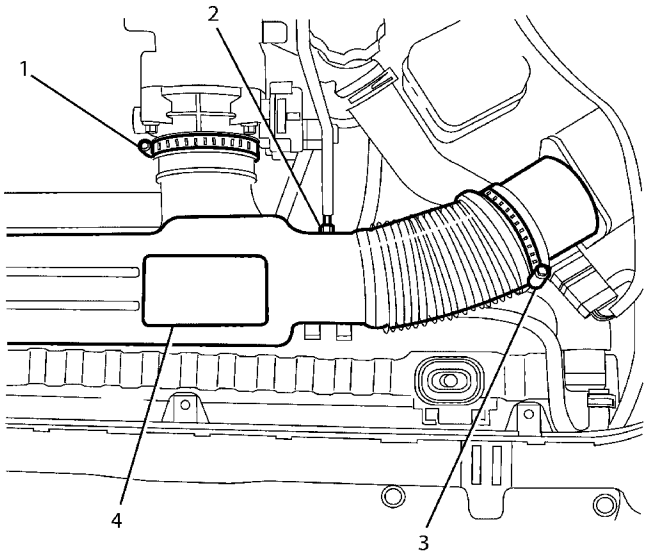
1. Install the air cleaner intake duct (4) to the engine.

   Caution: Refer to Fastener Caution in the Preface section.

2. Tighten the air cleaner duct clamps.
3. Install the air cleaner duct to throttle body retaining clamp (1) and tighten to **4 N·m (35 lb in)**.
4. Install the air cleaner duct to air cleaner assembly clamp (3) and tighten to **4 N·m (35 lb in)**.
5. Install the PCV hose (2) to the intake duct resonator.

Air Cleaner Outlet Duct Replacement

Removal Procedure



1. Remove the radiator air upper baffle and deflector. Refer Radiator Air Upper Baffle and Deflector Replacement.
2. Remove the positive crankcase ventilation (PCV) hose (2) from the air cleaner inlet duct (4).
3. Remove the air cleaner inlet duct to throttle body retaining clamp (1).
4. Remove the air cleaner inlet duct to air cleaner assembly clamp (3).
5. Remove the air cleaner inlet duct (4) from the vehicle.

Installation Procedure

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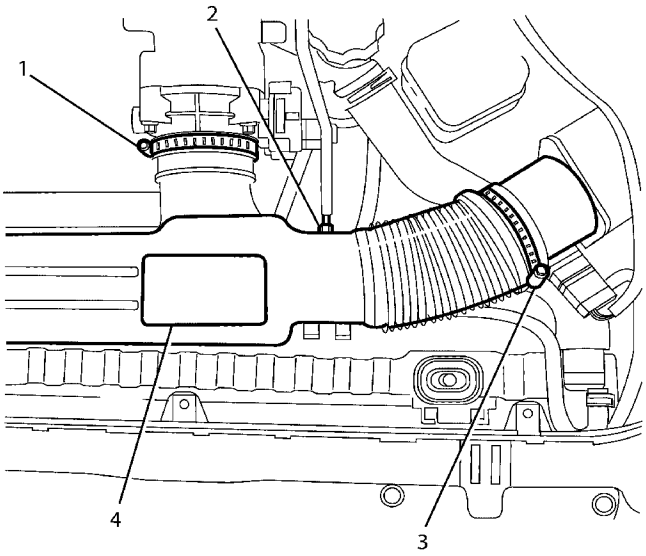

1. Install the air cleaner inlet duct (4) to the engine.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the air cleaner inlet duct to air cleaner assembly clamp (3) and tighten to **4 N·m (35 lb in).**
3. Install the air cleaner inlet duct to throttle body retaining clamp (1) and tighten to **4 N·m (35 lb in).**
4. Install the PCV hose (2) to the air cleaner inlet duct (4).
5. Install the radiator air upper baffle and deflector. Refer Radiator Air Upper Baffle and Deflector Replacement.